THE GEOGRAPHICAL JOURNAL

IOWA STATE TEACHERS COLLEGE
JAN 25 1960
LIBRARY

Vol CXXV Parts 3-4 September-December 1959

THE PRESIDENTIAL ADDRESS, 1959 The Rt. Hon. Lord Nathan 293
INNERMOST BORNEO: TEN YEARS' EXPLORATION AND RESEARCH Tom Harrisson 299
EXPLORATIONS IN PATAGONIA Eric Shipton 312
THE ANTARCTIC VOYAGE OF M.V. *THALA DAN*, 1958 Phillip Law 326
GEOPHYSICAL INVESTIGATIONS OF THE COMMONWEALTH TRANS-ANTARCTIC EXPEDITION H. Lister and Geoffrey Pratt 343
GEOMORPHOLOGY IN AUSTERDALEN, NORWAY Cuchlaine A. M. King 357
THE GLACIERS OF MOUNT BAKER, RUWENZORI John B. Whittow 370
THE MOVEMENT OF SHINGLE OVER THE SEA BED CLOSE INSHORE C. Kidson and A. P. Carr 380
INVESTIGATIONS INTO THE SOILS AND AGRICULTURE, LOWER DIYĀLA AREA, EASTERN IRAQ C. W. Mitchell 390
THE COMMERCIAL USE OF PEAT IN NORTHERN IRELAND James H. Johnson 398
THE PLUVIAL AGE IN THE PUNA DE ATACAMA C. Vita-Finzi 401
FROM THE *JOURNAL* A HUNDRED YEARS AGO 404
A FOUNDER OF MODERN GEOGRAPHY: Review G. R. Crone 405
"THE LEAF OF THE WILD PLUM WHEN AUTUMN HAS COME": A GEOGRAPHY OF CHINA: Review Paul Wheatley 407
AN ECONOMIC GEOGRAPHY OF "NORDEN": Review Hallstein Myklebost 411
A HISTORY OF THE PATHANS: Review Lord Birdwood 414

THE ROYAL GEOGRAPHICAL SOCIETY, LONDON, S.W.7
JOHN MURRAY (PUBLISHERS) LTD., 50 ALBEMARLE STREET, W.1
PRICE ONE POUND

THE GEOGRAPHICAL JOURNAL is the journal of the Royal Geographical Society and is edited by the Director. It contains accounts of recent exploration and travel, original contributions to geographical research, papers read at the meetings of the Society, and articles on every aspect of geography as well as on the geographical aspects of other sciences. It is fully illustrated with photographs and with maps compiled or drawn from the authors' surveys by the draughtsmen of the Society. It contains also reviews of geographical books and maps; the Society's News; a Record of geographical work; and letters from correspondents. Contributions to the *Journal* should be addressed to the Editor.

The *Journal* is sent free to all Fellows of the Society. Copies are available to the public from the Office of the Society. It may also be ordered through booksellers and John Murray (Publishers) Ltd., 50 Albemarle Street, W.1, who is responsible for trade distribution.

The subscription rate is Forty-three Shillings (Forty-two Shillings and Sixpence overseas) per year, post free, single copies Ten Shillings, plus postage.

ADVERTISEMENTS: All inquiries for Advertisement space in the *Journal* should be addressed to the Office of the Society, Telephone Kensington 2173.

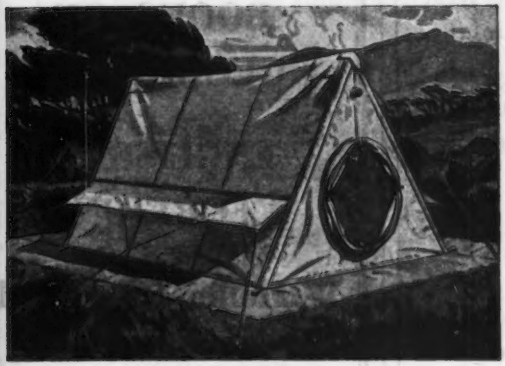
Neither the Society nor the Editor is responsible for the opinions or statements of contributors to the Geographical Journal.

The Postal Address of the Society is
KENSINGTON GORE, LONDON, S.W.7
The address for Inland Telegrams is
OBTERRAS SOUTHKENS LONDON
and for Cablegrams
OBTERRAS LONDON
The Telephone Number is KENSINGTON 5466 (5 lines)

BY APPOINTMENT
TO HER MAJESTY THE QUEEN, TENT AND FLAG MAKERS

BENJAMIN EDGINGTON

(SILVER & EDGINGTON LTD.)
144, SHAFTESBURY AVENUE,
LONDON, W.C.2

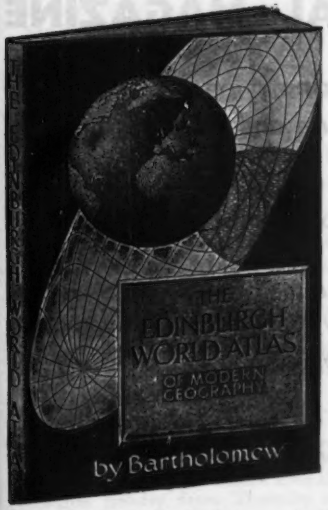


THE AUTHENTIC MOUNT EVEREST 2-MAN MEADE TENT

SUPPLIERS OF CAMPING AND MOUNTAINEERING EQUIPMENT TO ALL THE LEADING EXPEDITIONS

MAKERS
OF THE
MEADE & WHYMPER
TENTS
&
MOUNT EVEREST
DOUBLE SLEEPING
— BAGS —

CATALOGUE FREE ON REQUEST



THE EDINBURGH WORLD ATLAS

OF MODERN GEOGRAPHY

For the scientifically-minded. Reference maps in contour colouring. Many special subject maps. Geographical tables, world projections, index, etc. Bound in buckram and blocked in gold.

168 pages. Size 15 in. × 10 in.

Third Edition **Just Published**

36/-

JOHN BARTHOLOMEW & SON LTD

URGENTLY REQUIRED

PERE LABAT'S MEMOIRS
(of the West Indies)
or any French editions.

Also:

Books (pre-1900) on the West Indies, including Martinique, Guadeloupe;

Views of Jamaica by Hakewill, Kidd, &c., Hallewell's Bermuda, Cuba views, &c.

Please write:

FRANCIS EDWARDS LTD.
83 Marylebone High Street, London, W.1

HEFFER'S

BOOKS ON GEOGRAPHY

ENGLISH & FOREIGN

W. Heffer & Sons, Ltd.
Petty Cury, Cambridge

THE GEOGRAPHICAL MAGAZINE

The British Magazine of Travel, Adventure and Exploration

Specially reduced subscription rate for Fellows and Corporate Members of the Royal Geographical Society: 28s. a year to any part of the world (normal inland rate, 37s.).

New subscribers are invited to place their orders direct with the Publishers (and not through the Society), forwarding the appropriate remittance in sterling or in local currency at the ruling rate of exchange.

Associate Members have the choice of receiving either The Geographical Journal or The Geographical Magazine.

THE GEOGRAPHICAL MAGAZINE
Friars Bridge House, Queen Victoria Street, London, E.C.4

ROYAL GEOGRAPHICAL SOCIETY

PROVISIONAL PROGRAMME OF MEETINGS

JANUARY—MARCH 1960

Friday 1 *January at* 3 *p.m.*
THE BRITISH SEAS. *By Professor E. G. Bowen*
A joint meeting with the Geographical Association and the Institute of British Geographers

Monday 4 *January at* 6 *p.m.*
HORTOBAGY. *Hungarian film with English commentary*

Monday 11 *January at* 8.30 *p.m.*
EXPLORATIONS ON THE BOLIVIAN–PERUVIAN BORDER. *By W. H. Melbourne and P. Garrard*

Monday 18 *January at* 5 *p.m.*
LAND USE AND SEDIMENT YIELD IN AN OLD PLANTATION TRACT OF THE SERRA DO MAR, BRAZIL. *By Peter Haggett*

Monday 8 *February at* 8.30 *p.m.*
THE CHANNEL TUNNEL. *By H. J. S. Harding*

Monday 15 *February at* 6 *p.m.*
To be announced later

Monday 19 *February at* 5.15 *p.m.*
SPACE NAVIGATION. *Contributions from the Royal Greenwich Observatory, Herstmonceux*
A meeting of the Institute of Navigation open to Fellows and Members of the Society

Monday 29 *February at* 8.30 *p.m.*
AN OXFORD EXPEDITION TO BRITISH GUIANA. *By A. J. Cain*

Monday 7 *March at* 5 *p.m.*
MEDICAL GEOGRAPHY IN INDIA AND PAKISTAN. *By A. T. A. Learmonth*

Monday 14 *March at* 6 *p.m.*
UNDERWATER EXPLORATIONS OFF SICILY AND CYRENAICA. *Colour films with introduction and commentary by N. C. Flemming*

EXHIBITION: THE MAPPING OF BRITAIN

An exhibition organized by the Ordnance Survey will be on view from December 29 to January 20 inclusive.

THE SOCIETY'S HOUSE

The House of the Society is open from 9.30 a.m. to 5.30 p.m. on weekdays and from 9.30 a.m. to 1 p.m. on Saturdays. The Library is open for the exchange of books from 7.45 p.m. to 8.15 p.m. before Evening Meetings. The House will be closed for the Christmas holiday from Thursday evening 24 December to Monday morning 28 December 1959.

By Order of the Council, L. P. KIRWAN, *Director and Secretary*

AN ATLAS OF WORLD AFFAIRS

Andrew Boyd's essay in political geography has been welcomed very widely as a penetrating guide to the world's trouble spots. It has been revised and brought up to date, and is now bound in paperback. **With 70 maps and commentaries, 6s.**

KARIBA *The Struggle with the River God*

Frank Clements tells the *whole* story of the damming of the Zambesi at Kariba. It is extremely controversial in its survey of the political and geographical problems of the scheme, the construction of the dam, and its effects. **Illustrated, 16s.**

THE ST. LAWRENCE SEAWAY

T. L. Hills has written 'a concise, valuable handbook' (*Technology*), which deals with the economical, political and geographical background of the Seaway, the creation of the project and possible future events. **Illustrated, 12s. 6d.**

THE ESKIMOS

Kaj Birket-Smith's classic work is now available in a revised and extended second edition. It gives a most attractive and scholarly account of all eskimo tribes from Greenland to the Bering Strait. **Illustrated, 32s. 6d.**

WEST AFRICA

F. J. Pedler's well-known Home Study Book, a general introduction to the West African scene, has had a brief account of recent political and economic changes added for the second edition. **12s. 6d.**

METHUEN'S ADVANCED GEOGRAPHIES

New revised and enlarged editions of volumes from this series include L. Dudley Stamp's **Asia** (55s.), Griffith Taylor's **Australia** (37s. 6d.) and E. W. Shanahan's **South America** (25s.). A revised edition of T. W. Freeman's **Ireland** (45s.) is in preparation.

METHUEN *36 Essex Street · London W.C.2*

NOW PUBLISHED ★

BEACHES AND COASTS

C. A. M. KING, M.A., Ph.D.
Lecturer in Geography,
University of Nottingham

It is forty years since a book of this nature was published on processes at work on the coast and on the evolution of different coastal areas. Much work has been done during this period and in recent years Dr. King has been an active investigator in this field. The book is not concerned merely with the beaches and coasts of Britain but with those of the whole world, and examples are taken from Scandinavia, France, the Mediterranean area, Australia, New Zealand, India, Canada and the United States.

xii + 403 pages. 149 figures + tables. 65s. net.

EDWARD ARNOLD 41 Maddox Street, London, W.1.

CANADA
ARCTIC
ANTARCTIC

—●—

Out of Print
& Rare Books
Scientific Books
and Periodicals
Catalogues on request

Bernard Amtmann
750 Sherbrooke St. West
Montreal, Canada

"Enthralling"—SIR CHARLES PETRIE

"No one is better qualified than Professor Debenham to write about the Antarctic."
—LORD SHACKLETON

"The best book on its subject to date."
—SPHERE

"First-rate."—TRIBUNE

"Absorbing . . . a *vade mecum* to the icy South."
—TIMES

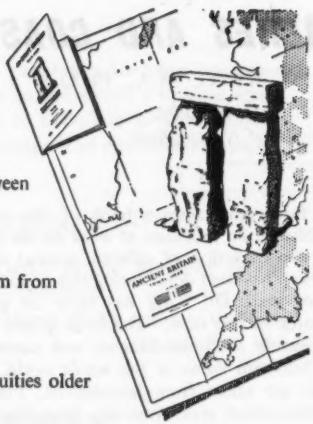
"Behind *Antarctica* lies a lifetime of personal experience and academic research."
—DAILY TELEGRAPH

ANTARCTICA, by Professor Frank Debenham, O.B.E., M.A., D.Sc. (Founder Director of the Scott Polar Research Institute) has a Foreword by Sir Vivian Fuchs. *Illustrated with 30 photographs, maps, and two-colour endpaper. Demy 8vo. 264 pages. 25s. net.*

■■■ **HERBERT JENKINS** ■■■

PICTURES OF BRITAIN'S PAST

The history of Britain can be studied with enhanced pleasure with the aid of the Ordnance Survey Period Maps:—



ROMAN BRITAIN
A map of Britain as it was during the period of Roman occupation.

BRITAIN IN THE DARK AGES (*two sheets*)
Maps showing sites of historical importance between the end of Roman rule and the accession of King Alfred.

MONASTIC BRITAIN (*two sheets*)
Maps covering the period of British Monasticism from the Norman Conquest to the Dissolution of the Monasteries.

ANCIENT BRITAIN (*two sheets*)
Maps showing the most important visible antiquities older than A.D. 1066.

ORDNANCE SURVEY MAPS

Key to the land of Britain

Obtainable from most booksellers and stationers

PUBLISHED BY THE ORDNANCE SURVEY, CHESSINGTON, SURREY

EXPLORERS JOURNAL

A scientific quarterly published since 1921 by The Explorers Club, 10 West 72nd Street, New York 23, N.Y., U.S.A. Five dollars per annum.

CLARKSON'S

Secondhand Optical Stores.

338 HIGH HOLBORN, (Old) LONDON, W.C.

Theodolites, Sextants, and other Surveying Instruments.
Telescopes, Prism Binoculars, &c.
By all the leading makers.

We supplied the Society with Prismatic Binoculars for the use of the Mount Everest Expedition

ANY USUAL OR UNUSUAL INSURANCE OR ASSURANCE

G. N. Martin, 55 Robin Hood Way, Coombe, S.W.15
KINgston 3236.

J. D. POTTER, 145 Minories, LONDON, E.C.3

ADMIRALTY AGENTS FOR CHARTS SINCE 1830
PUBLISHERS OF NAUTICAL BOOKS AND BOOKSELLERS

Complete stocks kept of all Admiralty Charts and other Hydrographic Publications. Publishers of the well-known navigational tables by Inman, Davis, Burdwood, etc., Fowlers' "Charts: their Use and Meaning," Harvey's "What Star is it?" Prince's "Seamanship as Applied to Towing," etc.

A large and comprehensive stock of NAUTICAL PUBLICATIONS of all descriptions is maintained at the above address.

PARALLEL RULERS, DIVIDERS, PROTRACTORS, SCALES, SLIDE RULES, CANVAS CHART FOLIOS, etc.

Telegrams: Adcharts, Fen, London. Cablegrams Adcharts London. Telephone: ROYal 1369.

Ex-Government

★ SURVEYING INSTRUMENTS ★

We carry a comprehensive stock of M.O.S. Survey equipment and our catalogue includes details of Binoculars, Telescopes, Plane Tables, Tripods, Aneroid Barometers, Drawing Instruments, etc.

LIQUID PRISMATIC COMPASS

(Service Pattern Mk. III).

Precision pocket instrument engraved 0°–360° in one degree divisions. The mother-of-pearl dial is suspended in non-freezing liquid. Adjustable magnifying prism. Well-made hinged case of 2 in. diameter. Net weight 11 oz. Current cost, approx. £13.

£3.18.6

HELIOGRAPHS

5 in. latest pattern with two spare mirrors. Double-jointed sighting rod, etc. Complete in leather case. Cost approx. £36. Brand new and perfect.

Price

£2.17.6

With Tripod.

INDIAN CLINOMETERS

Base 9½ in. Ministry Release at fraction of cost. New and unused.

£3.15.0

With leather case.

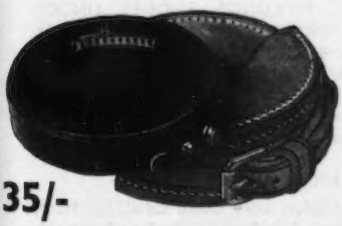
SURVEYING RANGEFINDERS

Coincidence type. Base 80 cm. Range 250–10,000 yards. Good serviceable condition.

£12.0.0

Short or tall tripod can be supplied as an extra.

REFLECTING CLINOMETER



35/-

An extremely compact Clinometer measuring 2¾ in. in diameter and weighing only 6 ozs. Angles of up to 45° elevation and depression can be read instantly to an accuracy of 1° or interpolated to 15 minutes.

Complete in leather case.

Brand new condition.

ABNEY LEVELS

—Ex. M.O.S.

The most popular of the minor instruments for measurement of vertical angles, this pocket size reflecting level is the standard type, extending by two draws to 7". The silvered arc is divided 0–90 degrees elevation and depression, and vernier can be read through the adjustable magnifier to within 10 mins. These fine instruments are complete in leather case and are offered in new condition at approximately half price.

£3.15.0

6×30 CANADIAN NAVAL and BAUSCH & LOMB PRISMATIC BINOCULARS

Eyepiece focusing. Estimated cost £30. Price with web case **£10.15.0** With leather case £1 extra.

Instrument makers and suppliers of scientific equipment since 1907. Actual makers of paraboloidal telescope mirrors, special purpose flats, prisms, etc.

CHARLES FRANK

★ 67-75 SALTMARKET, GLASGOW, C.1. ★

Phone : BELL 2106/7 Grams : 'Binocam' Glasgow Send for Catalogue

HELLENIC TRAVELLERS CLUB

1960 Hellenic Cruises

Under the Patronage of the Vice-Chancellors of
Oxford, Cambridge, Glasgow, Aberdeen and Reading Universities

Cruise No. 18. **SARDINIA, SICILY, NORTH AFRICA, MALTA, GREECE & YUGOSLAVIA**

2nd April to 18th April, 1960.

Visiting SAVONA, CAGLIARI, NORA, PALERMO, MONREALE, SEGESTA, TUNIS, CARTHAGE, DOUGGA, AGRIGENTO, TRIPOLI, SABRATHA, LEPCIS MAGNA, MALTA, SYRACUSE, OLYMPIA, DELPHI, OSIOS LOUKAS, CORFU, PALAEOKASTRITSA, DUBROVNIK, TORCELLA, VENICE.

Cruise No. 19. **GREECE, TURKEY & YUGOSLAVIA**

16th April to 2nd May, 1960.

Visiting VENICE, OLYMPIA, ATHENS, DAPHNI, ELEUSIS, SOUNION, DELOS, MYKONOS, CAPE HELLES, GALLIPOLI, TROY, THE BOSPHORUS, ISTANBUL, PERGAMUM, SELJUK, EPHESUS, ANTALYA, PERGE, ASPENDOS, SIDE, RHODES, LINDOS, KNOSSOS, MALLIA, GORTYNA, PHAESTOS, PYLOS, DUBROVNIK, VENICE.

Cruise No. 20. **SICILY, GREECE, TURKEY & THE BLACK SEA**

23rd August to 10th September, 1960.

Visiting SAVONA, SYRACUSE, OLYMPIA, KNOSSOS, RHODES, LINDOS, SELJUK, EPHESUS, CAPE HELLES, TROY, BURGAS, NESSEBER, VARNA, THE BOSPHORUS, ISTANBUL, PERGAMUM, DELOS, MYKONOS, ATHENS, DAPHNI, ELEUSIS, SOUNION, CORINTH, SICYON, PATRAS, TORCELLO, VENICE.

Cruise No. 21. **GREECE, TURKEY, CYPRUS, LEBANON & YUGOSLAVIA**

8th September to 26th September, 1960.

Visiting VENICE, OLYMPIA, NAUPLIA, EPIDAUROS, ASINE, MYCENAE, TIRYNS, ATHENS, DAPHNI, ELEUSIS, SOUNION, DELOS, MYKONOS, RHODES, LINDOS, ANTALYA, PERGE, ASPENDOS, SIDE, LIMASSOL, NICOSIA, KYRENIA, FAMAGUSTA, SALAMIS (optional air excursion to JERUSALEM & BETHLEHEM or DAMASCUS & PALMYRA), BEIRUT, BYBLOS, BAALBECK, MALLIA, KNOSSOS, DUBROVNIK, VENICE.

Each cruise will be accompanied by six Guest Lecturers who will give lectures on board and at the various sites visited.

Guest Lecturers accompanying Cruises include :—

Mr. J. Boardman, Sir Maurice Bowra, Sir William Calder, Lord David Cecil, Sir Harry Luke, Mr. Michael Maclagan, The Rev. Gervase Mathew, The Rev. Canon Guy Pentreath, Professor W. B. Stanford, Professor Eric G. Turner, Mr. J. B. Ward Perkins, Sir Mortimer Wheeler, Mr. D. R. Wigram and Sir John Wolfenden.

Prices From 85 Guineas

(INCLUDING TRAVEL LONDON–VENICE AND RETURN)

For full particulars and reservations, apply to :—

W. F. & R. K. SWAN (HELLENIC) LTD.

260 (HI8) TOTTENHAM COURT ROAD, LONDON, W.I.

Telephones : MUSeum 8070 (12 lines)

Share your adventures

with 2,400,000 member-families of the National Geographic Society

What's your line? Travel . . . exploration . . . research . . . nature? Do you deal with the world and its life . . . the exciting conquest of space? Your recent experiences, submitted in manuscript form, may be just right for publication in the richly illustrated National Geographic Magazine. Human-interest photographs (35 mm color or monochrome) are also wanted. We'll gladly consider your material and pay you generously for all manuscripts and pictures accepted.

Each month, The Society portrays in its famous Magazine the peoples and places of our changing world. Scores of leading explorers and travelers have contributed to its pages since 1888. You, too, can add to your income by sharing your stories and pictures with the global-minded members of this nonprofit educational organization. Write today for booklet describing our editorial requirements.

MELVILLE BELL GROSVENOR
B. S., D. Sc., F. R. G. S., Editor

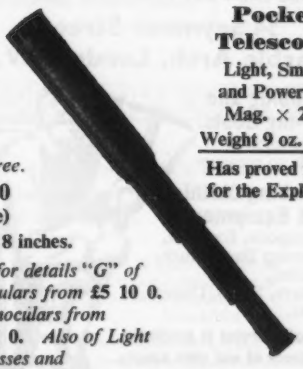
NATIONAL GEOGRAPHIC MAGAZINE
WASHINGTON 6, D.C. U.S.A.

Advertisements :

All inquiries for Advertisement space in the *Journal* should be addressed to the Office of the Society.

Telephone : Kensington 2173

LIGHTWEIGHT TELESCOPES AND BINOCULARS



"BIRSPY" Pocket Telescope
Light, Small and Powerful, Mag. × 20.
Weight 9 oz. only.
Has proved ideal for the Explorer.

Post Free.
£8 0 0
(in case)
Closed 8 inches.

Write for details "G" of Monoculars from **£5 10 0.** *and Binoculars from* **£11 11 0.** *Also of Light Compasses and Altimeters, etc.*

J. H. STEWARD, LTD.
OPTICIANS AND SCIENTIFIC INSTRUMENT MAKERS
406 STRAND, LONDON, W.C.2
Telephone : TEM. 1867. *Estab. 1852*

An atlas of wide scope and appeal

PHILIPS' LIBRARY ATLAS

The Library Atlas is likely, by its comprehensiveness and the variety of information it contains, to meet any demand made on it. It will support the work undertaken by the scholar, and serve equally, by reason of its detailed index, as a work of general reference.
176 pages of reference maps, presenting a considerable number of place-names against a physical background. The regional maps have been given on particularly generous scales. Included with these are maps showing natural vegetation, structure, geology, soils, volcanoes and earthquake-zones. In addition to the physical maps, there are 32 pages of economic maps, 15 of which give world distribution of commodities such as wheat, rubber, date-palms, spirits, etc. All maps are in full colour. The 24 pages of preliminaries include 252 graphs showing the climate of selected stations throughout the world. There is an 88-page index of over 50,000 names. 11 by 9 inches.

Boards, **50s.** net.

GEORGE PHILIP & SON LIMITED
30–32, FLEET STREET, LONDON, E.C.4.

Telephone: PADdington 5252.
Telegraphic Address: 'Alpinist,' Wesdo, London.

ROBERT LAWRIE LTD.

Alpine and Polar Equipment Specialists

54 Seymour Street,
Marble Arch, London, W.1.

Climbing and Ski-ing Boots, from stock or made to measure.

Climbing Clothing and Equipment. Crampons, Ice-axes, Sleeping Bags, Rucksacks, Jackets, Socks, Duvets, etc.

Repair Service is available to Boots of our own supply. Genuine Vibram soles and heels available.

Orders by Post.

Illustrated catalogue on application.

Business Hours—
Daily 9 a.m.—5.30 p.m.
Thurs. 9 a.m.—7 p.m. (late closing).
Sats. 9 a.m.—12 noon (early closing).

BOOTMAKERS AND SUPPLIERS to the Successful BRITISH MT. EVEREST EXPEDITION, 1953, ETC.

ROLEX

WATCHES

Supplied officially to The Royal Society's International Geophysical Year Antarctic Expedition

THE ROLEX WATCH CO., LTD.
1, Green Street, Mayfair, London, W.1

The Commonwealth

"More needs to be done in this country to bring home to children and young people the nature and significance of the Commonwealth as a living and growing partnership."
Studying the Commonwealth—its peoples, history, geography, products and development—leads to numerous possible projects.
Over the years, EP has devoted considerable thought to this subject. Visual aids—wallcharts, filmstrips and books—are available on every country, many prepared in collaboration with the Governments concerned.

Commonwealth Information Project

"The best visual aid on the Colonial Empire"—*New Schoolmaster.*

Inspection copy on request.

Write for a copy of the EP leaflet on the Commonwealth to East Ardsley, Wakefield.

"Protecting the face against scorching on the snows was a problem in the days before Glacier Cream."
The Times.

GLACIER CREAM

A protective cream for mountaineers, skiers, and those exposed to strong ultra-violet rays either direct from the sun or reflected off snow and ice.

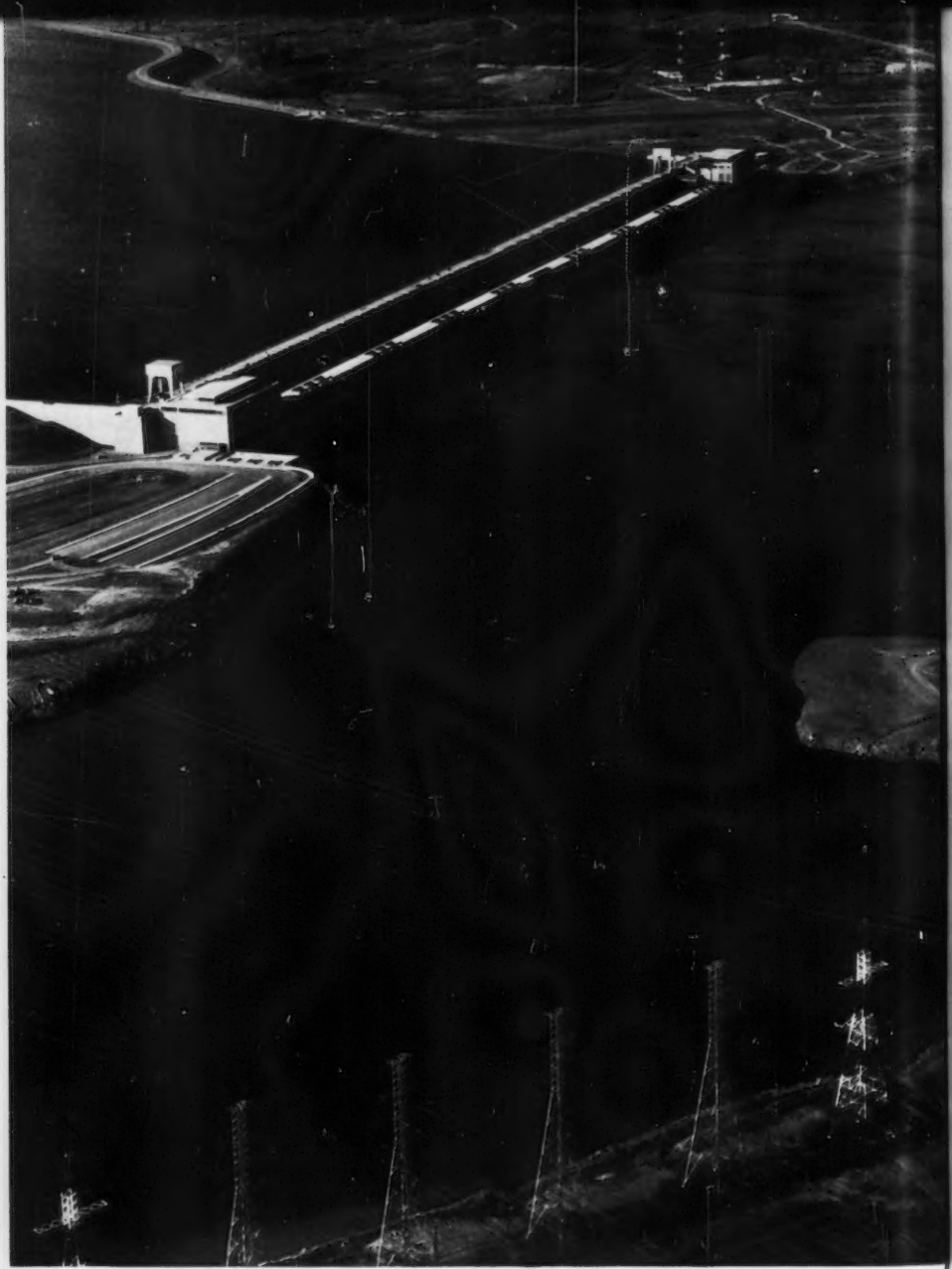
NORMAL (Green Label). For altitudes up to 6,000 feet: can be applied as a foundation cream under powder or lipstick without loss of protective powers.
Price 2/10 a tube.

HIGH ALTITUDE (Red Label). For use over 6,000 feet, and also in severe conditions. As used on Mount Everest and Antarctic Expeditions.
Price 3/8½ a tube or pot.

From all chemists or direct (post free) from:

SAVORY & MOORE LTD.
143 New Bond St., London, W.1

By Appointment to H.M. The Queen, Chemists



Photograph: Malak, Ottawa

The St. Lawrence Seaway, opened by H.M. The Queen and by President Eisenhower, 26 June 1959: international powerhouse structure linking Canada (foreground) and the U.S.A.

The
GEOGRAPHICAL JOURNAL

Vol CXXV Parts 3–4 *September–December 1959*

THE PRESIDENTIAL ADDRESS

THE RIGHT HONOURABLE LORD NATHAN

ON THESE OCCASIONS it is customary for your President to review the principal developments of the past year and to say something of future needs and future trends. Being neither a geographer nor an explorer by profession, I can at least claim to approach both these topics with a fresh and unbiased mind.

First, our meetings: as during my distinguished predecessor's, Sir James Marshall-Cornwall's, Presidency, attendance at meetings of all kinds has been generally large. In a programme which was evidently full of themes attractive to our membership, it is not easy to single out lectures for special mention, but I think that Dr. Paul Siple's film and talk on United States activities at the South Pole during the International Geophysical Year were particularly notable—and, indeed, the film itself (the work of the National Geographic Society) was unique. The past year has inevitably been very much of a polar year, and two other important lectures were that by General Laclavère, the Director of the Institut Géographique National, about Antarctic developments during the I.G.Y., and the lecture by Dr. Waldo Lyon on the trans-polar voyage of the nuclear-powered submarine, *Nautilus*, whose captain, Commander Anderson of the United States Navy, is our Patron's Medallist today. As far as other parts of the world were concerned, Captain Smallwood's account of contemporary Mongolia and Mr. Akester's account of his Saharan expedition were two of the most entertaining talks that we have heard. Although climbing is a matter for the Alpine Club rather than the Society, Sir John Hunt's description of his expedition to the Caucasus mountains was particularly welcome, since this was the first British expedition to visit the Soviet Union since the War.

As usual, the technical afternoon meetings covered a wide range of academic subjects, but I would in particular like to mention the lecture last January by Professor A. L. Banks, concerned with the geography of disease. This is a most promising and important field of research which I hope very much will commend itself to the Society and to British geographers in all our universities, and I am glad to be able to tell you that it has been decided to follow up Professor Banks's suggestions for a National Committee on Medical Geography by establishing, as a first step, a special committee of the Council to explore these matters. This will consist both of geographers and medical men. I have some interest in medical matters and I have agreed to become chairman of that committee, the results of whose labours I hope will be worthwhile.

As in previous years, we have continued our policy of mounting exhibitions of

interest not only to our Fellows but to the general public. Last Christmas, in commemoration of the official end of the International Geophysical Year of 1957–8, we staged a highly successful UNESCO exhibition, "The Earth as a planet," which was seen by more than 15,000 people, including parties from a number of schools. In the field of publication, in which our distinguished Director and Secretary, Mr. Kirwan, has a special interest, a notable event has been the publication of the sixth General Index to the *Geographical Journal* covering the years 1943 to 1954. Another important event has been the publication of a facsimile of the Gough Map with an accompanying memorandum by Mr. E. J. B. Parsons of the Bodleian Library, a member of our Library and Maps Committee. This appears under the joint imprint of the Society and the Bodleian Library at Oxford. Those of you who have seen this coloured map will know that it is a unique national treasure dating from the middle of the fourteenth century. It is, indeed, the only existing map of Great Britain of that period and the earliest to show roads. Another valuable cartographical publication has been the issue of the second sheet of the Society's map of Southern Arabia, and I would like to mention with gratitude in this connection the work of Professor R. B. Serjeant of the School of Oriental and African Studies of London University who has greatly aided us in the complicated, and controversial, task of the orthography of many thousand Arabic place-names.

The work of your Council and all its various committees has continued unabated throughout the year. Of the latter, none has been more active than the Finance Committee which has, as in so many previous years, been under the chairmanship of our devoted Honorary Treasurer, Mr. Leonard Brooks. I will not refer in any detail to their work because I shall be asking Mr. Brooks himself to tell you something about the finances of the Society later on this afternoon. The Education Committee, under the chairmanship of our Honorary Secretary, Dr. E. W. H. Briault, is, as you know, very widely representative of school education in geography at all levels. Almost every year it has put forward refreshing proposals for the advancement of geographical education and this year it originated the idea of an annual prize for a geographical essay to be awarded to students of training colleges in England and Wales.

Perhaps the most active of our committees has been our Research and Expeditions Committee. Its chairman is Professor J. A. Steers of Cambridge, but this year, due to Professor Steers's absence in the United States, our Honorary Foreign Secretary, Major-General R. Ll. Brown, has for some months been acting in his place. I want to dwell a little on the work of this committee because the promotion of exploration both on our own account and through our affiliated organization, the Mount Everest Foundation, continues, even more than in the past, to be a most important task. The principal preoccupation of this committee, of course, is with the large number of travellers and expeditions which apply annually to the Society for grants and other aid. This year (apart from those applying only to our affiliated Mount Everest Foundation) no less than forty-three applications were received and it is a sign of the high standards we insist upon that only twenty-one candidates were successful. Most of these expeditions have received grants of money. Some have been lent surveying instruments which, as you know, are in the care of our able consultant in surveying, Mr. Alfred Stephenson of the Imperial College of Science and Technology. In the past year aid in another form has been made possible by generous grants from the Calouste Gulbenkian Foundation. This has enabled us to purchase a number of expensive ciné-cameras and other photographic equipment, all of which have been put to full and continuous use. As regards financial aid, I

would like particularly to refer to the first grant made from a newly founded Latin American Travel Fund. This fund, which is still in its early stages, has been fostered very largely by the British and Latin American Chamber of Commerce with the Society as trustees, and the subscriptions collected in the past year have enabled us to assist a highly qualified geographer from Cambridge University to undertake research in Brazil, the results of whose work I hope may later be made available to us.

Before I leave the general topic of expeditions and travel, I would like to put before you some thoughts about exploration which have recently preoccupied your Council. These principally concern the increasing number of expeditions which approach the Society nowadays for help, but which contain little or no geographical content. Reactions differ on these developments. Some may be inclined to argue that we should confine our support and our interest only to those expeditions which are concerned mainly with purely geographical studies. Zoological expeditions, botanical expeditions, expeditions from the newly founded exploration clubs set up by medical schools—these, they may feel, should be left to the care of the relevant organizations in each case. There is, however, a difficulty in this. Since the War, and perhaps even before the War, the Society has been recognized generally as the national centre for exploration and it has seemed perfectly natural to all these applicants to apply to us for help. Then a further difficulty has arisen; the remarkable growth of enthusiasm for exploration since the last War, especially among the young, has been accompanied by a considerable increase in the sources of support, not only in terms of money, supplies and reduced fare facilities, but in many other ways. This support has been forthcoming from a number of new and different directions: from the great Foundations; from large commercial and industrial organizations which have, of recent years, so generously supported the large national expeditions to Everest and the Antarctic with which we have been so closely connected; and, in terms of transport facilities, sometimes from government departments. All this, of course, has been a most welcome development, but none of these organizations have the time or the means properly to investigate the various applicants who apply to them. They have increasingly, therefore, turned to the Society for this task, knowing that we have here a great accumulation of knowledge and experience about the technique and organization of travel.

Taking into account these various factors, your Council has recently decided to define more closely its policy towards exploration. It is naturally impossible for us out of our limited resources to provide financial support for all these expeditions concerned with subjects which are not our own. It has therefore been decided to restrict financial support to expeditions which have some geographical content and to make this restriction known. On the other hand, it has been increasingly felt that we have a moral, and a national, obligation to help in advising travellers and expeditions which fall outside the strictly geographical field. We intend, therefore, to make it known that we are prepared to receive applications from all these other expeditions and to approve them, or not, as *bona fide* projects even though they are not eligible for financial aid. But I must emphasize that approval in such cases would not necessarily imply approval of the scientific content of the expedition's programme. In some fields, this might well be quite beyond our competence. Approval will, in such cases, be generally confined to matters such as planning, organization and technique, on all of which we are well qualified to advise. This service will not only be of assistance to all those organizations which are so generously supporting exploration at the present time. It will be of help to expeditions of

all kinds for whom the approval of the Society is very often more valuable, from the point of view of recruiting further support, than the relatively modest grants of money which we are able to make. I myself very warmly welcome these developments. A broad interest in and patronage of exploration has always been in the traditions of the Society, and I think that most of us will agree that to restrict this interest and patronage too closely within narrow academic limits would be a retrograde step. We have also to look forward to the future of exploration. Large expeditions these days must, because of cost, be left for the most part to government organization. On the other hand, governments are not concerned with the smaller parties working in a wide variety of scientific fields. It is these who increasingly look forward to us for assistance, and it is not only in our own but in the national interest that we should help them. There is, too, a growing realization in this country of the psychological and social value of expedition training in the development of youth, not only of undergraduate but of less than undergraduate age. These are developments in which personally I am keenly interested. A remarkable lead in this respect has been given by our much-travelled Honorary Member, His Royal Highness the Duke of Edinburgh, and it may well be that in future years the sort of activities which he is encouraging in this country can be extended to include expeditions abroad. Initiative, unselfishness, a better understanding of other lands and other peoples—these are some only of the invaluable lessons expedition life can teach. To encourage by every means this latent spirit of adventure among the youth of this country and of the Commonwealth, and to guide it along the right lines, seems to me to be a duty most appropriate to our Society in this new Elizabethan Age.

Such possibilities as these, which I commend to your attention, depend of course ultimately on finance. Here we have been more fortunate than many societies, comparatively speaking, and our membership of all kinds, which I mentioned just now, numbers 7000; higher, that is to say, than it has ever been in the Society's history. I would particularly like to mention here the continuing, and immensely valuable, support which we are receiving from our Corporate Members, to whom we have been able to add five more, including, I am happy to say, the Bank of England.

There is, however, another side of the picture which is less promising. Costs have continued to rise in a number of directions, as our Honorary Treasurer will tell you, and on top of these we are faced by the possibilities of a very serious rise indeed in the cost of printing and publication. This, if it comes to pass, may inflict very heavy and perhaps irreparable damage, not only on this Society but on all learned and voluntary societies whose foremost duty is the publication of scholarly work.

I turn now from these broader matters to the work of the several departments of the Society and of our capable and energetic staff. First I should mention our Director and Secretary, Mr. Kirwan, who is really the linchpin of it all and who brings to bear not merely a skilled devotion but a great patience and an unlimited expenditure of time and energy. There could not be of a Society such as this a Director and Secretary more loyal to its interests, more skilled in fulfilling its functions or more loyal to those in whom official responsibility may rest. And I take this opportunity in front of you all in expressing my own and, I am sure, your own appreciation. Now, immediately in front of me is Professor Dudley Stamp, one of our Vice-Presidents, and I turn next to the Library and Maps Committee, of which he is Chairman. The Library, whose future needs have recently been investigated by an expert panel of our Library and Maps Committee, has continued to provide a valuable service to Fellows in London and elsewhere, and there has been an

The President, Lord Nathan, presents the Patron's Medal to Commander W. R. Anderson, U.S.N.: 15 June 1959. Left: the Society's Honorary Treasurer, Mr. Leonard Brooks

Keystone Press

increase both in the number of books borrowed and in the number consulted on the premises since 1957–8. In the re-cataloguing of our Library, which I would remind you is the finest private Library in this country within its own specialized sphere, we have been helped again this year by a further generous grant from the Pilgrim Trust. The Map Room, for which, you may remember, we receive a modest annual subvention from H.M. Treasury, has now to provide for an annual intake of maps from all parts of the world, which is more than double the pre-war figure. The provision of extra space for the storage of maps is a serious problem confronting our Library and Maps Committee. For the moment, through improvisations of various kinds, the situation is in hand, but soon we may be forced to find additional accommodation for our rapidly increasing collections. In regard to the Library and Maps Collections, the Librarian and Curator of Maps, Mr. Crone, has been for long a devoted servant of the Society—he has, indeed, written a short history of its most recent years—and we must pay our tribute to his services, and also to Mr. Day and to Mr. Dugdale who assist him so valiantly in the work of the Map Room and Library respectively.

The Drawing Office under our Chief Draughtsman, Mr. G. S. Holland who, we are all very glad to see, is numbered this year among those to receive our Awards, has had a very full programme, with work continuing on the Everest map and with further work in hand on an extensive map of Spitsbergen. It has also, with some assistance from one of the government departments of survey, been at work on some of the great mass of cartographical material gathered over past years in Arabia by our distinguished Fellow and Gold Medallist, Mr. H. St.J. Philby. One of the busiest sections of the Society, and I am glad to mention this because the administrative side is so often overlooked and taken for granted, is the General Office under the immediate management of Mr. D. H. Backhouse; it is concerned not only with the day to day finances of the Society but with the affairs of our seven thousand Fellows and Members. This is a heavy burden of work on a staff smaller than before the War and we are fortunate in having in Mr. Backhouse such a capable and energetic servant of the Society.

Before concluding this address I would like to say a word or two about the external relations in the Society. As you know, the Society is represented on a wide range of committees of different kinds in this country, and to these have recently been added the new British National Committee for Geology where our representative will be Professor Dudley Stamp, and the new British National Committee for Antarctic Research where we are no less admirably represented by our senior Honorary Secretary, Dr. Edward Hindle, F.R.S., and by Sir Miles Clifford, one of our Vice-Presidents—a former Governor of the Falkland Islands and an experienced Antarctic traveller.

Looking further afield, we have made a special effort this year to enlarge our contacts with geographers abroad. This was enjoined upon us by our Founders and it is, now as then, a most important function of our Society. In November last I was in the United States and most of my time was spent in trying to organize the visit here of Commander Anderson and to secure the approval of the Navy Department of the United States—with what success you can see by the fact that he is here! But in the intervals of doing that my wife and I were entertained by the American Geographical Society in New York in their magnificent House there. I was glad to be there, for with that Society our own Society has long had cordial relations, and I am pleased to tell you that I was able to take with me and to present to them a copy of the recently published Gough Map, which I know they were delighted to have.

When I was in America I had the great pleasure of meeting Fellows there of this Society living in the States of New York and New Jersey, and I wished that I could have met other Fellows elsewhere. I am bound to tell you, because I think you will be interested to know, that some of these Fellows, especially those who hailed from this country, were delighted to meet the President of the Society; they told me they always look forward to receiving the *Journal*. I had hoped also to attend the celebrations in Berlin last May of the centenary of that great man, one of the founders of modern geography, Baron Alexander von Humboldt. This, however, proved impossible, but the Society was represented by the Director and Secretary, Mr. L. P. Kirwan. I think it is good not only for the Society but for the country that our work should be as widely known as possible abroad, and I am glad therefore that our Director and Secretary, during a recent archaeological lecture and research tour in Sudan and Libya sponsored by the British Council, was able to give a number of talks on the work of the Society in those countries, and I hope there may be other visits abroad in the near future when we can do the same.

I must close this address by a brief reference to less happy matters, namely to the losses which our Fellowship has suffered in the course of the year. Foremost among these was the death of Sir Douglas Mawson, our Fellow and Gold Medallist. He was not only a famous Antarctic traveller but a very eminent scientist, and we are particularly fortunate in having had presented to us, through the generosity of Sir Lloyd Dumas and other Fellows of the R.G.S. in Australia, a fine portrait of Sir Douglas Mawson painted by Mr. Ivo Hele. Another loss in the field of exploration was that of Sir Hubert Wilkins, the great pioneer of polar aviation and submarine navigation. There was also (and very recently) the death of Mr. Cherry-Garrard, a member of Scott's last expedition. His story of his part in it will undoubtedly remain one of the most widely read accounts of Antarctic adventure. Then there was the premature death of one who for many years had been very closely connected with our work, Mr. Augustine Courtauld, the Arctic traveller, who was not only a former member of our Council but for some years also Honorary Secretary. It is a lasting encouragement to all of us that he, who knew our work so well, was so confident of the future prosperity of the Society and so convinced of the unique part it undoubtedly has to play in the future of our national life.

INNERMOST BORNEO: TEN YEARS' EXPLORATION AND RESEARCH

TOM HARRISSON

IT IS MORE than twelve years since I delivered a paper to this Society on wartime explorations in Central Borneo; that was on 6 January 1947, and the paper was subsequently revised and extended for publication to cover post-war work in 1949.[1] Recently I brought these remarks up to date and, with colour films to illustrate the broadening front of interest, spoke to the Society on 8 October 1958. The present paper aims to outline what has happened "inside Borneo"—in the interior, beyond the limits of continuous river communication—over the subsequent decade. And there is much to tell.

During these last ten years all the remaining plums of pure exploration have been picked and swallowed. There is really nowhere in Borneo significantly "new" left to go, no major peak left unclimbed or valley left unvisited by at least one serious student now—perhaps excepting the headwaters of the great Iwan tributary of the Batang Kayan in Kalimantan, rising near the Usun Apau. We are moving instead forward into new mysteries and back into old ones—scientific problems which have tantalized enquiring minds ever since, over a century ago, Alfred Russel Wallace led the way to objective studies, spending more than a year (November 1854 to January 1856) in Sarawak. For although there are still gaps in the island's accurate geography, these are as nothing compared with the vast gaps in our knowledge of other sciences in Borneo. Happily, however, the British (western and northern) parts of Borneo offer special attractions to the new scientific explorers. These three territories—North Borneo, Brunei and Sarawak—are peaceful states, with still primitive travel facilities, but with vast tracts of unspoiled country—sparsely inhabited inland by varied, friendly, intelligent people. Moreover, whereas before 1946 these were all relatively "backward" countries—in the sense that they had small budgets, few international contacts and very small (or no) scientific staff (or scientific outlook, for that matter)—during the past ten years each of the three has had much enlarged funds available for research and related activities. The mentality which welcomes, and sometimes applies, such research has grown in parallel.

In the fourth and largest Bornean territory the process has not been quite the same. Kalimantan (as it is now termed since becoming independent as part of Indonesia) is experiencing some difficulties consequent upon an almost complete severance from the past research resources of the Dutch, who were at one time ahead of the British territories in this respect. These difficulties tend to become acute far inland in the eastern part of Indonesian Borneo, which must be easily the most difficult country to administer from Djakarta: it contains no Mohammedans, but several great and imperfectly understood "pagan" tribes.

It is difficult even in 1959 to understand what has happened in Central Borneo without referring back to the largest single change affecting the whole island in historic times: the Japanese occupation of 1941–5. This not only overthrew European order but also had two other important results. It ran down interior administration, always the first casualty, to a new low ebb; and at the same time, although demonstrating immediate Japanese incapacity, it did indicate Asian ability to do a lot more than anyone in those parts had previously dreamed of.

These changes reached their climax along the routes the Japanese took into the interior under the pressures of heavy fighting[2] against the "inlanders" themselves in 1945—see, for instance, their routes in Sarawak, Brunei and North Borneo marked by arrow-headed lines on the folding map. But the effect was not limited to areas and people which came into direct contact with the Japanese. A major result of

Inside Borneo, as it was in 1947

the occupation has been that, in a vague but quite perceptible way, the interior of Borneo itself for the first time has grown self-aware, has felt related to a suddenly, violently, intrusive outside world. The islanders began to want to be "in on things;" they wanted to be heard, seen and even studied, instead of being left to stew in their own huge jungle. This trend extends, of course, throughout Asia, and Central Borneo has moved quietly, but with extreme sharpness, out of a placid past into the fringes, at least, of a present which is increasingly subject to the influences of

science. The roots of this change have already been indicated in previous studies.[1, 2] But they need to be emphasized before we examine specific items, since the point is vital—and the process continues. The whole tempo of Borneo, and especially Central Borneo, has altered almost out of recognition since 1945. Where I was dropped by parachute then—at Bario the highest Kelabit upland village (3500 feet) —we had to send miles away to find a man who could speak Malay; to reach the nearest "civil servant" of any kind—dresser, policeman, teacher, "upriver agent" —meant more than ten days of arduous travel. Today, virtually every man, woman and child speaks Malay, and a good many speak English. Six "civil servants" live within an easy day's walk; a score of other Kelabits are serving or training to serve on the coast. One is a trained archaeological assistant in the Sarawak Museum, another an agricultural assistant; several have qualified as school-teachers and medical dressers. Such is the heart of Borneo, on the British side, and widely so, in 1959.

Survey and air transport.—The task of surveying Borneo is still a large one. On the ground, major surveys have been completed in North Borneo. Sarawak lost all its survey data for the Fourth Division (second largest of five) through Allied bombing in mid-1945; by late 1958 the whole division had been re-surveyed and cadastral plans and land registers renewed.[3] In the past decade much of British Borneo has been surveyed from the air by modern techniques, initiated in 1948. But much of the interior uplands has so far defied high-flying photographic methods, owing to constant cloud formations about and above the very rugged middle-level mountains at 4000 feet or so. In particular, the upland areas provisionally mapped at the time of my 1949 paper have not been covered, and data for the newly explored southern uplands are still imperfect. A new effort inland is planned for the near future. The map facing p. 302 aims to give only a simple idea of what we now know—it represents an advance on 1949 and includes areas barely known to non-natives even by name then.

Other air activities have been considerable. The interior airfield I built at Balawit in 1945[1] lay in Indonesian territory and has long lapsed. But in the latter half of 1958 the Indonesian Government employed local labour to build a very large airfield further up the Bawang valley right against the Sarawak border. No plane has yet landed there. After 1948, the Borneo Evangelical Mission (based on Australia) built up a network of Auster strips in Sarawak (Lawas, Long Semadoh, Bah Kalalan, Lio Matu, among others). The North Borneo Government early had a Rapide feeder service to the Ranau foothills of Mount Kinabalu, which is 13,455 feet and the highest peak in South-east Asia. At Bario I built a strip with local help in 1952, but it was abandoned after a Shell Auster (with me in it) crashed in taking off. In 1958, the Sarawak Government took a hand in the building of airstrips and have now re-made Bario, and improved Mission strips elsewhere; they have made new ones at Belaga and Long Akar, to run a Twin Pioneer feeder or charter service in 1959 in conjunction with the other two British Governments ("Borneo Airways"). Tourists may soon be able to reach in an hour the remotest places, barely heard of by native Malays or Chinese of the coast ten years ago.

In Kalimantan, aircraft were used in 1958 to drop regular salt supplies to the densely populated Long Nawang area of the great Batang Kayan river, cut off from the east coast by the impassable Brem Brem rapids and—unlike the Kelabit country—without local salt springs. The North Borneo Government pioneered the use of supply drops for out-stations and field parties; and Sarawak has lately been doing this with effect for the World Health Organization, and for geological parties.

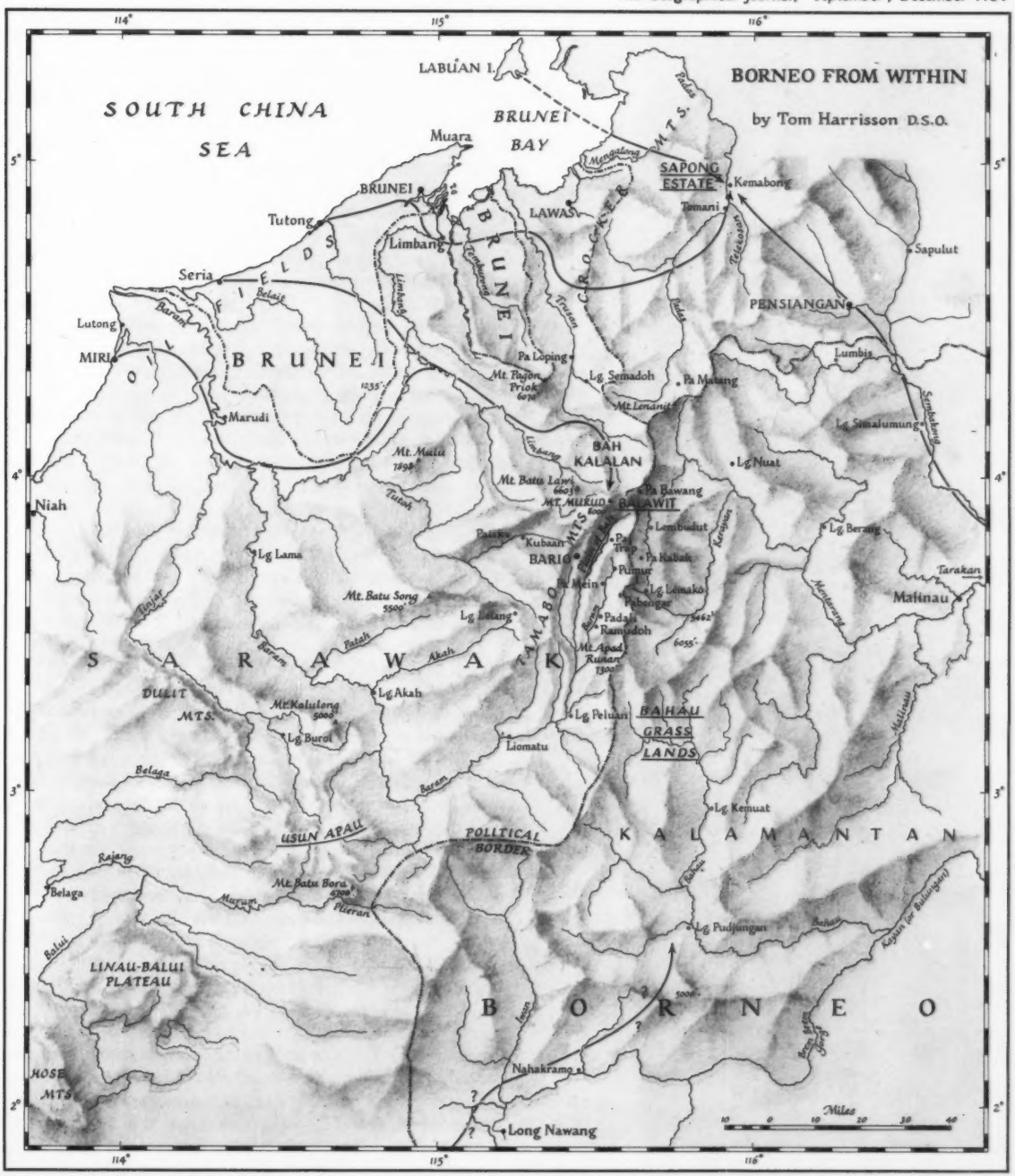
In March 1959 an R.A.A.F. medical team with Sarawak's civil aviation officer, Mr. John Seal, made the first peacetime drop of personnel, an emergency relief job, into our original 1945 dropping zone at Bario. The Oxford University Usun Apau Expedition of 1955–6 was also able to stay for a protracted period of scientific exploration in an uninhabited part of Sarawak thanks to systematic supply drops organized by the Geological Survey and the Sarawak Museum.

The country is particularly difficult for such work, however—largely owing to the complicated patterns of rivers and mountains, the featureless jungle and the present lack of meteorological predictability. The continued failure to complete the air survey indicates this. Few other countries in Asia are so geographically "messy," I think.[1] This is a feeling the traveller gets very strongly on the ground; and the indigenous peoples feel it too, whenever they are in unfamiliar places. Fear of being lost in the jungle is deep and real in the far interior. It is quite a simple matter to get so lost.

The uplands in the interior.—The high, flat plains cultivated by the Dusun and other hill peoples of North Borneo have been well known since the last century, partly because there is little river travel in the north. European pioneers in these parts learned to go on foot, instead of sitting in boats and being propelled by others —the normal method for senior persons over nearly all the rest of Borneo. Thus North Borneo early appreciated such areas and incorporated them in its thinking. This region, for instance, led in the establishment of internal communications—by pony, by jeep and now by air. In the other countries, the central uplands were further away and *felt* less accessible; and they were almost ignored. Even Charles Hose, massive collector and long resident in north Sarawak, author of many works, never visited the Kelabit uplands. During and after the war these areas came into prominence for tactical reasons. There followed a wide awareness that beyond the river lines lay relatively healthy, potentially rich lands, sometimes densely inhabited (Kalimantan), and sometimes sparsely (Kelabit). My own interest in such areas naturally continued after the war.

I have been able to spend a total of nearly three years in this and related upland areas since then, and to become fully acquainted with the pleasures of highland living near the equator. (At Bario, the minimum shade temperature is often below 54° F, absolute maximum only 92° F; solar radiation is high; the total effect invigorating.) In particular, full-scale studies have now been made of Kelabit culture and folklore, and of their uniquely elaborate system of erecting megalithic stone and other monuments in connection with the journey of the spirit of the dead. More is now known of their method of redistributing property on a large scale, also in connection with these ceremonies for the dead, at tremendous *irau* feasts[4] (see below).

Extensive zoological surveys have been made over the years for the first time in any upland area. Borneo's fauna markedly changes above about 3000 feet. The Kelabit country lies about and above this division and contains a very interesting complex of montane and lowland animals intermixed. Some high-level forms, notably birds and mammals, have colonized downward and adapted themselves even to cultivated, open country, both here and in the Ranau plain round Mount Kinabalu. Others have spread up from the lowlands and occupied montane habitats.[5] Many more have not made these transitions either way, sometimes strangely; for instance, the fine Fireback Pheasant of the lowlands is common around Bario, but Borneo's other two famed pheasants, the Argus and Bulwer's, never occur there—though the former reaches the outer side of the surrounding



Published by the Royal Geographical Society

6000 feet mountain barrier. Comparable work on the flora has not yet begun. A close geological survey of the area by Dr. N. S. Haile and Dr. G. Wilford is in progress. The Kelabit area used to be visited by an outsider every two or three years. Today there is a growing stream of visitors attracted by this different, highland world within. This also had the effect of making some of us look further afield, to the previously unstudied high country south of the Kelabit.

The southern uplands: the search for "Usun Apau."—Vague reference to highland areas south of the main Baram have been known for years. I first heard such talk myself when I crossed from the Tinjar into the Belaga (Rejang) on the Oxford University Expedition of 1932.[6] In 1947 the Sarawak Museum started methodically recording folklore in the interior. The term "Usun Apau" soon became conspicuous, among the Berawans and Sebops of the Tinjar, among the "Kenyah proper" of the main Baram, and the Badangs of Lio Matu and other groups. The Usun Apau was their old homeland, high and far, above the navigable river-lines which these people now, without exception, inhabit. It was (old men and stories said) cooler, healthier, more fertile, rich in wild sago and game, good timber and jungle produce. Much of it was "flat" (by Borneo judgement), and relatively easy to get about on foot—unlike the lower valleys. The Usun Apau was variously placed in Sarawak and Indonesian Borneo, between the headwaters of the Tinjar-Baram and the Bahau-Kayan in Kalimantan. It seemed to merge into other and, interrelated, areas, notably another "Usun" in the upper valley of the Iwan, which flows southward into the Kayan between the Bahau and the political border (see folding map).

Apau is a widely used term, varying by dialect, to indicate the upper reaches of a river, usually the more level headwater valley divided from the lowlands by a gorge and rapid system obstructive to navigation. The Kenyahs and Kayans apply this (as Apou, Apoh, Apo, etc.) to most large rivers, except the main Baram—which they call throughout and always Telang *Usan*. The Dutch adopted the term administratively, notably for the Apo Kayan, the Kayan River above the Brem Brem rapids. *Usun* is a less used and largely traditional term, related to widespread Dusun ("garden," with the connotation of open country); but the word is applied in this area to specific places indicating that they are elevated and by inference have been cultivated and are fertile. To pursue native terminologies too far in Borneo always becomes sterile and often contradictory; we may leave this one at that!

As a result of this initial ethnological approach, I decided that such a place as Usun Apau must really exist, although all its settled population had long since moved into the lowlands—partly, apparently, through pressures of population increase; partly to scatter from the forward-pushing and aggressive forays of the Iban Sea Dayaks as they extended northward into the middle Rajang in the last century; and largely, also, because more settled conditions on the coast, with stable European governments replacing previously anarchical phases of Sultanates then in decline, made trade attractive and lowland conditions in general more acceptable. I therefore decided to go and see for myself. This proved difficult for no one, then, knew the way. First, I repeated, in 1950, my 1932 journey from the Tinjar into the Belaga,[6] to talk to the small groups there, Seping, Ba Mali, Punan, etc. These all also felt they came from the Usun upland. It was nearer to them than the Tinjar people, many thought; but they had no declared idea of the way.

After much further cross-examination, aided by the then District Officer, Baram (Mr. A. R. Griffin), an expedition was mounted to push right up the Tinjar, past Mount Kalulong (first climbed by our 1932 expedition).[6] I was fortunate in

getting my friend Mr. D. L. Leach, then Director of Land and Survey, Sarawak, to go with me. Leach and I left Kuching on 27 March 1951, left Long Buroi in the upper Tinjar on April 10, and proceeded to wallow our way up into the headwaters, travelling largely by compass and making our own tracks—a formidable business in Borneo jungle. Such informants as we had were soon lost. We kept on hitting gorges and ridges which we had to go round. By dividing into two parties and travelling all daylight hours, however, we made slow progress up and on to the south-east, the deduced direction of search.

Our initial party was one of twenty-eight Sebop Kenyahs, twenty (nomadic) Punans, two Kelabits and two Malay survey assistants. Our initial problem was food anxiety. How could we carry enough food for a protracted journey through uninhabited country of this sort? Sixteen days is about the limit to which a party can go carrying its own rice (on which all Borneans absolutely depend) with minimal equipment to record scientifically; this has long been the accepted view. We had to plan for longer than that, and did so by an elaborate series of depots and relays plus a concentrated attack on jungle food and by imposing strict party discipline.[7] (This was before peace-time drops by parachute became available.)

By April 18 we had reached a divide at 2800 feet, after slowly rising into level country which fitted all the traditional descriptions, and differed markedly in form from the familiar Borneo route-marches Leach and I both knew too well. We had little idea where we were; but most nights we painfully made clearings and Leach took astrofixes. These have since only partly been tied up with air survey (for reasons already indicated). Working along what now visibly became a plateau formation, running south and east, largely "flat" as in the folklore, we were gratified, on April 20, to reach a river system flowing south. We had clearly crossed out of the Tinjar-Baram watershed. Presently we identified this river from tradition and later from newly contacted nomads; it was the Pek, a tributary of the Manawan, which flows into the Plieran-Rajang. The position of the Pek and Manawan junction was 2° 49′ 29.8″ N., 114° 31′ 25.8″ E.

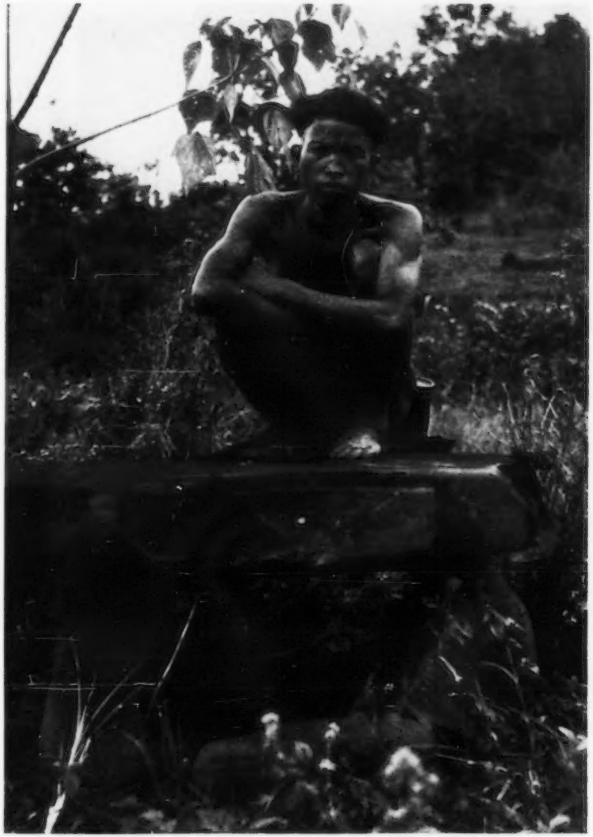
On April 23 we found, with pleasure, evidence of past human habitation, the unmistakable floristic after-effects of long-time longhouse occupation on the bank of the river, now 20 yards wide. Here we decided to build a boat, and for four days we did so, hollowing out a great *maro* tree, after firing the inside. The *Burong Gunong* ("Mountain Bird") took the surviving eleven of the party on in comparative ease. We now passed through impressive, rather open, jungle land which Leach likened to some of the best New Zealand cattle country and I to the southern edge of the Kelabit country around Long Peluan (see folding map).

Next day we came to a greater river. Portering over falls, shooting rapids, poling, pulling and paddling with our new blades, at the end of April we reached the Plieran—hitherto, like all this area, unvisited by outsiders—and met a party of Punan Gang. These nomads could supply sago and wild game, which made things much easier. We still had a long way to go; but at least we now knew where we were. On May 4, after twenty-five nights out in the jungle and twenty-six days solid travel without seeing a mountain, a garden or a baby, I reached the uppermost Kayan house on the Rajang, Leach bringing on the "specimen" party next day. We were back at the coast by 11 May 1951. If I may quote what I wrote locally at that time[7]:

"What did the expedition achieve? It added 1600 square miles to the map and altered the map greatly. It entered for the first time the great Plieran-Danum-Murum branch of the Rajang, the only previously unexplored river system in

Mount Kinabalu from 4000 feet: Lewis Peak (13,455 feet) at centre

Negotiating a waterfall on the Usun Apau tableland



Kelabit uplands: (left) Avenue of menhirs, overgrown by jungle; (right) Small dolmen, connected with burial rites

Borneo. . . . It established beyond any doubt the existence of a tableland or plateaus with a past extensive population, and perhaps of considerable importance in the *future* of Sarawak. Soil samples and zoological collections were made in this connection. Valuable new material was brought back for the Museum. And incidentally the validity of treating native folklore collected by research staff as pointers to real and actual past facts, was established with certainty."

The zoological collections suggested a mixed montane-lowland fauna not dissimilar from that of the rather higher Kelabit formation; and subsequent work has enlarged this view. Our soil samples showed silting loams and clays in the Manawan to Plieran sector, with "pH values similar to those found for upland soils in Malaya," and very high P_2O_5 in one case. The senior soils chemist, Malaya, thought that if these were associated with basic volcanic rocks they could be very good.

In fact they were so associated. For a significant by-product of the trip came from geological samples taken at each astrofix point, and these proved to be largely of volcanic origin. This conclusion stimulated a spate of geological activity, towards and around the Usun Apau, culminating in Dr. Kirk's 1957 memoir (already cited).[6] Encouraged by these interesting results, later in May 1951 I joined an R.A.F. Mosquito Survey Wing based on Labuan Island and made several sorties over the Usun Apau and adjacent areas. It now became clear that this was indeed a plateau, with one powerful escarpment and two superb waterfalls—probably the highest in Borneo—to the east of the point where we had climbed on to the top, the first Europeans to do so. Moreover, the whole northern headwaters of the huge Rajang river system could be seen as a great elevated zone, not fully recognized hitherto because all the branches of the river which are now settled to the south lay in more ordinary, eroded country. And flying straight up the Plieran over the Indonesian border, it was clear that the Iwan-Kayan headwaters were indeed interrelated highland—the border range here running low, the actual watershed (and political boundary) irregular and negligible. Here the Usun Iwan, another legendary population centre of the past, still remains unidentified on the ground.

While Shell and government geologists followed up the 1951 leads, the enterprise of an assistant conservator of forests, Mr. J. A. Anderson, M.C., carried exploration further south into the Linau-Balui section of the Rajang river labyrinth, during May and June 1953. He again encountered igneous formations and a somewhat elevated upper part of the Linau River called Lusong Laku. Further study of air photographs has provisionally formulated another distinct plateau formation in this area (see folding map). It is not yet known if it was ever settled by man; further ground study is required.

The settlement of the Usun Apau itself has fortunately been the source of further study since its "discovery." Most relevant here, in 1955–6 an Oxford University expedition under Mr. Guy Arnold, on my advice, selected this area for a mixed scientific field project, the most thorough of its kind undertaken in Borneo since the Oxford Tinjar-Dulit expedition of 1932. Mr. Arnold has already reported his geographical results to the Society.[8] The zoological collections are still being worked out in the British, Chicago and Sarawak Museums; while forestry and geological results have been incorporated in governmental department monographs. Four museum staff were attached to this expedition, including Lian Labang, a Kelabit who was with us on the 1951 crossing and was subsequently trained as an archaeological assistant. He worked with Arnold in a detailed study of old longhouse settlements in this now empty upland. From this it is proved that a large population lived remote there, but with appreciable prosperity for those days. It also appears

Kelabit uplands: (left) Avenue of menhirs, overgrown by jungle; (right) Small dolmen, connected with burial rites

that by the wholesale move into the lowlands these people may have lost a good deal. In fact, since our now widely understood (inside Borneo) "rediscovery" of the uplands, there is a considerable interest among far-seeing sections of the riverine populations in the idea of a *return* inland to their traditional, cool, spacious homeland. Improving communications may, in the near future, make this both desirable and practicable, for administrative, population and developmental as well as cultural and other reasons.

Some of the Usun Apau houses were over 300 feet long—a lot for "the old days," before standards of space were "improved" by outside contacts. There were at least fifteen large longhouses—as compared with only nine, some small, on the Kelabit plateau today. The excavation material is being studied in the Sarawak Museum. It is very different from equivalent material in Kelabit sites; and there seems to have been no direct link on any scale.

The Usun Apau longhouses, however, show evidence of much outside contact westward to the coast, before Rajah Brooke brought white government and order inland. Among porcelain pieces, even old English wares are included. Glass, beads, non-native iron and "outside" varieties of earthenware increase rapidly after *c.* 1850 in the area, too. These "outside objects" are conspicuously concentrated in the central median portion of the longhouse, thus confirming that these groups of Kenyahs (Sebops, Berawans, etc.) have not (as has been suggested) acquired their structure of class type—with aristocrats in the centre, grading roughly out socially to each end of the house—quite recently.

Mention must also be made of the discovery, originally from air photographs, of a lower (1200 feet) upland formation, nicknamed by geologist Dr. F. H. Fitch "Orchid Plateau," which lies in the Segama River area of north-east Borneo. Like the Usun Apau and Balui-Linan this is interpretated as derived from comparatively young lava flows.[9] There is no evidence of habitation.

It can fairly be said that Borneo has, in the past decade, become freshly aware of a fine and potentially valuable asset in its long neglected interior. The offer in the future is of moderate overspill for rapidly increasing populations—still well under 4,000,000 for the whole island—and a source of produce (both jungle and cultivated) not to be won in the equatorial lowlands. The centre of Borneo once throbbed with human life. Only in the last century did this come down and out, widely, from the heartland.

Man-made upland environments.—It follows that until the late 1950's "outside" man had really made no impression, visibly, on the interior. There are still no bridges, roads, wheels or concrete structures in the area under review, but the nibble of "civilization" is beginning, symbolized in tiny strips cut out of the vast jungle—landing ground for aircraft. The indigenous people themselves have nibbled also, over the centuries, with more effect. All the same, it is still possible to travel (as hard as you can walk, slither, climb and sweat) for days at a time over large tracts of the interior without trace or sign that any human has ever been here before (though, inevitably, a nomadic Punan or rhinoceros-hunting Iban has). It *is* perfectly possible, though, in part of the inland to get a sudden shock: to come across, at some seemingly impossible place—such as at the foot of Mount Batu Lawi's dramatic twin pinnacles or on the very summit of the almost intolerable pass from the Baram into the Bahau of Kalimantan—rocks carved into the shape of rhinoceros, or sandstone shaped into deep vats. Out of the great green nowhere, one may be smacked in the face by man at his most intense: creating from stone.

There are three ways in which the people of interior Borneo normally and

appreciably change the landscape deliberately. First and most conspicuous, nearly all of them fell jungle areas annually to provide clearings for rice agriculture. With a new, rapid population increase—encouraged by wide anti-malarial spraying by the World Health Organization, travelling dispensaries, new dresser services, medical missionary activities—the present estimated 80 per cent. of Borneo still under "virgin" jungle is threatened by rapid modification from these slash-and-burn agricultural methods. The threat is least of all, however, in the far uplands.

The other two ways are only practised inland in limited areas of the uplands: extensive irrigation to produce permanent rice fields independent of felling; and movement of rocks or changing of irrigation projects to provide funeral memorials, mostly megalithic structures. The former is practised on a large scale by the Kelabit, Murut and related people in the north-west corner of Kalimantan,[1] and to a smaller extent in the headwaters of the Trusan and Baram rivers in Sarawak. A number of upland plains in North Borneo, north of Keningau, are similarly cultivated by the Kwijau and Dusun peoples. One aspect of Dusun demography was studied by the 1956 Cambridge Expedition.[11]

I have given a broad account of Sarawak irrigational methods in a recent book.[2] The most remarkable manner of deliberately modifying topography has lately been practised only in the Kelabit country and the immediately adjacent part of Kalimantan. Here large rocks are moved long distances to be erected as sometimes impressive lines of menhirs; powerful dolmens are constructed; boulders too large to move in the river beds are carved or shaped into human, monster or symbolic forms; deep ditches (called *nabang*) are cut along pathlines to bisect ridges or mountain passes—or are dug *across* the path and bridged with carried stones, in some cases brought from the plain below up to 5000 feet. And the wild skyline of mountain ranges encircling the Kelabit upland is broken at scores of points by what look at a distance like niches, but are in fact long and wide rides, where all trees have been felled to make another sort of *nabang*—to speed the spirits of the dead in their journey to the upper world. Several of these mountain "rides" are on top of Mount Murud, 8000 feet, the highest mountain in the central interior, at the meeting point of Sarawak, North Borneo and Kalimantan.

The idea of megalith-making is closely linked with the idea of irrigation; the two go side by side. Indeed, under certain conditions it is as, or more, satisfactory to mark a death-rite celebration by cutting an irrigation ditch as by bisecting a ridge or erecting a dolmen. This idea is carried to quite astonishing lengths when applied to upland *rivers*. In Kelabit eyes it is a feeble community that has rivers with big loops near its longhouse. "Straighten your river" is a form of insult. Periodically, at the death of a great man, a major operation may be undertaken to remedy this defect in nature. After careful study, a ditch is made at either end of a potential short-cut across a loop, where the river is perhaps 30 feet wide. This is done with a view to water rushing down from above, exactly where it should pile up at the other end of the bend. If necessary a line of stones is suitably placed to insure the later effect. On the next heavy rain this should—and often does—break through. The old river is shortened. Since the upland Kelabits have no canoes, the benefit is firstly spiritual and secondly that the resultant ox-bow may be good for fish—perhaps for keeping fish (which the Kelabits regularly do by pond irrigation). The village of Pa Dali once made such an ox-bow over a mile long, and for years used the rich river-bed earth on irrigated rice fields. This may be the origin of the deviation, though nothing is really explicable by such a single, simple explanation anywhere in Borneo's interior!

"*Inside Borneo's" future?*—The peoples of the interior (until lately head-hunters) were, through difficulties of terrain and the deliberate policies of previous regimes, relatively untouched by western civilization until 1945, and comparatively little was known about them. They are pleasant, generous, energetic, interested in ideas and with a keen sense of beauty and of experience. Much of the country they inhabit is difficult. As exploration and research (as well as new ideas) clarify their past and present position, they are becoming interested in re-adjusting their own way of life. A tremendous recent swing-over from animism to nominal Christianity is one symptom of this phase. Another is a revived awareness of the empty lands inside. Tied up with this is the inevitably approaching stage when communications between coast and centre will be a hundred times easier than hitherto. Some groups have not thrived in the lowlands, the Kenyahs for instance. Others, like the Ibans, with long lowland traditions, are increasing so rapidly that they already constitute a serious sub-coastal land problem for others. The uplands were abandoned because groups were pushed down by others, or because they wanted to be nearer supplies of salt and (latterly) iron and cloth, and because of security. In the near future these factors may no longer operate.

The empty heart of this great island could presently acquire a new significance. Meanwhile, it is relevant to continue scientifically to explore and analyse the geographical terrain and the human and other life—present, past and future—of Borneo's great interior.

APPENDIX

Mountain exploration in Borneo

It is improbable that any separate high mountain now remains unclimbed in Borneo. However, no one has yet succeeded in climbing the higher ("male," ? 6600 feet) shining, white, crumbling, sandstone pinnacle of Mount Batu Lawi's twin pinnacles; though Penghulu Lawai and four other Kelabits manoeuvred me to the top of the fearsome enough lower ("female") peak.

Two of the most puzzling heights, whose very existence was sometimes doubted, were the Hose Mountains in Sarawak and Mount Tibang on the Indonesian border. The latter's presence was amusingly queried by Mr. B. E. Smythies, but has since been securely fixed.[10] Much biological work, with special reference to topographical formation, altitude and local weather effects modifying montane faunas, remains to be done. The 1956 Cambridge Expedition's effort on Mount Trus Madi, in North Borneo, the island's second highest distinct peak (8134 feet), was only a beginning, but it was of special value in proving, through the work of John Boyes and his Dayak assistant, R. Nyandoh (Sarawak Museum), that vertebrates hitherto regarded as confined to the upper zone of Mount Kinabalu (13,455 feet) also occur there; and therefore that, although the very top levels do bring in special forms, these are probably never (in Borneo) quite exclusive to one massif.[11]

The first scientific exploration of the only major mountain in the State of Brunei, Mount Pagan Priok (6070 feet; see map), was made by a government botanist, Mr. Peter Ashton, in 1958. Unfortunately, his collections were lost in a rapid on the way back to the coast—a common (and generally unnecessary) occurrence on such expeditions. In a March 1959 expedition with Dr. E. J. H. Corner, F.R.S., of Cambridge, Mr. Ashton was again unlucky: he trod on a pit viper far inland, had to be carried down to the coast in a Dayak basket, and nearly died. He is now happily quite recovered.

Kinabalu, first climbed by Hugh Low in 1851—and nowadays several times a year —remains unique, pre-eminent, the highest and grandest mountain in South-east Asia. The higher levels of granite and stunted forest afford exceptional facilities for a

wide range of scientific studies, owing to relatively easy access by aircraft, then bridle-path, then well-trained Dusun guides. The first organized highland planting of vegetables and coffee in Borneo was begun at Kundasan, east of the Bunda Tuhan pass, at about 4200 feet (average maximum temperature here 78° F., minimum 58° F., humidity 68 per cent.) late in 1958. An ambitious project to make part of the splendid Kinabalu mass into a National (really International) Park, commemorating incidentally the miseries, braveries and loyalties of all races in Borneo during the Japanese war (1941–5), has recently been launched by a well-known Borneo surveyor, my wartime colleague-in-arms Mr. G. S. Carter, D.S.O., now of the senior Shell managerial staff at Seria, Brunei.[12] This is receiving widespread support—signifying again the new and lively concern with the fuller use of Borneo's rugged inland. Carter and I also spent an exciting week living in the little Paka Cave, at 10,000 feet on the mountain, exploring the summit zone and studying its remarkable fauna. Parties from the U.S. Scrub Typhus Research Unit, Chicago Natural History Museum and the U.S. National Museum have also worked near the summit lately, as has B. E. Smythies.

The "climbing" potential of the breath-taking cliffs (some over 5000 feet), on the north-east face of Kinabalu have recently been explored by Myles Bowen and other Shell geological personnel; Dr. Bowen also completed the first ascent of Mount Batu Bora, dominant peak in the Usun Apau uplands, in 1954. And in March 1959 a party of Murut schoolboys from the interior school at Long Semadoh (which I started in 1945) on the Trusan climbed Mount Murud, Sarawak's highest (8000 feet) from the north for the first time. Previous known ascents, including my own and that of Kelabits making funerary clearings, have all been up the precipitous, but more readily approachable, south face. By the same token, a party of youths of all races from the Batu Lintang Training College at Kuching have since crossed the Usun Apau, led by Mr. A. G. Smith. The young, too, are becoming highland-minded in Borneo.

One of the few whispers we have had out of Indonesian Borneo in this decade is a sensational account of a French "expedition," entitled 'Head-hunters of Borneo,' painting a picture of dangers and perils from snake, bear, blowpipe, rapid and mountain which can only be described as laughable.[16] Such so-called explorers can be a nuisance. They tend to upset the interior peoples, as yet unaccustomed to their new-found celebrity. Communications, available porters, guides, interpreters and food supplies are still so limited (in the interior) as to put a severe strain on local goodwill if travelling is abused. In this, the serious visitor always tends to suffer: he has a long-term job to do, and cannot afford to over-pay, exaggerate, loiter or be unscrupulous.

REFERENCES

[1] Harrisson, T., "Exploration in Central Borneo," *Geogr. J.*, **114** (1949), pp. 129–50.

[2] Harrisson, T., 'World within: a Borneo story,' London, 1959, Part III.

[3] Information by courtesy of Brigadier M. Hotine, C.M.G., Director of Overseas Survey, Colonial Office; the Director of Lands and Surveys, Sarawak, Mr. C. B. Murray (see their Annual Report 1957); and Mr. Bruce Reeves, D.S.C., parallel officer in North Borneo. (For survey purposes, Brunei has hitherto worked with personnel seconded from Sarawak.)

[4] Harrisson, T., "A living megalithic in Central Borneo," *Sarawak Mus. J.*, **8** (1958), p. 695; *ibid.*, p. 394, and other papers in that *Journal*. For background, *J. Polynes. Soc.*, **58** (1949), p. 91; see also note 2.

[5] Davis, D. Dwight, "Mammals of the Kelabit Plateau," *Fieldiana, Zool.*, **39** (1958), pp. 119–47, on that aspect; on birds, Dean Amadon and Tom Harrisson, American Museum of Natural History, *Novitates* (in press); also B. E. Smythies, 'Birds of Borneo,' Edinburgh, in press, for the broad picture.

[6] Harrisson, T., "The Oxford University Expedition to Sarawak, 1932," *Geogr. J.*, **82** (1933), pp. 385–410. Also H. J. Kirk, Geological Survey Dept., British Borneo, Memoir 8, 1957, p. 7; 'Bornean jungle,' 1947 (T. Harrisson, ed.).

[7] Harrisson, T., and D. L. Leach, "Towards the Usun Apau," *Sarawak Mus. J.*, **6** (1954), pp. 66–95, gives a detailed "administrative" account of these travel procedures.

[8] Arnold, Guy, "The Oxford University Expedition to Sarawak, 1955–6," *Geogr. J.*, **123** (1957), pp. 167–78; *Oxford University Exploration Club Bulletin*, **9** (1958), pp. 9–25; and 'Longhouse and jungle,' London, 1959. For a general discussion of inland and coastal "development" trends, see F. W. Hodder, in *Geographical Studies*, **3** (1956), pp. 71–84.

[9] Fitch, F., Geological Survey, British Borneo: Memoir 5, 1955, p. 14.

[10] Smythies, B. E., "The riddle of Gunong Tibang," *Sarawak Mus. J.*, **7** (1956), p. 122; *cf.* N. S. Haile and H. J. Kirk, *Sarawak Mus. J.*, **8** (1957), p. 177, discussing Smythies and giving a general survey of travel in that area since 1950.

[11] Wood, D. P. J., and B. J. Moser, "The Cambridge Expedition to North Borneo, 1956," *Geogr. J.*, **124** (1958), pp. 56–68. Zoological material in press.

[12] Carter, G. S., 'A tragedy of Borneo, 1941–45,' Brunei (Kuala Belait), 1958—includes a chapter on highland agricultural potentials, by Kidman Cox, and another on Kinabalu wild life by T. Harrisson.

[13] Freeman, J. D., 'Iban agriculture,' London (H.M.S.O.), 1955.

[14] Geddes, W. R., 'The land Dyaks of Sarawak,' London (H.M.S.O.), 1954; and 'Nine Dayak nights,' Oxford, 1958.

[15] Polunin, Ivan, and Mary Saunders, "Infertility and depopulation," *Lancet*, **8** (1958), p. 1005; *cf.* M. Colebourne and others on effects of anti-malarial spraying throughout interior, *Sarawak Mus. J.*, **9** (1959), p. 200.

[16] Ivanoff, P., 'Headhunters of Borneo,' London, 1958; this, incidentally, amplifies some of the absurdities in C. Miller's 'Black Borneo' of 1946, discussed as damaging in the 1949 paper (see note 1).

DISCUSSION

Evening Meeting, 20 October 1958

Before the paper the PRESIDENT (The Rt. Hon. Lord NATHAN) said: Many of you here this evening will recall a lecture given about four years ago by Mr. Tom Harrisson on Borneo. Mr. Harrisson is a very old member of the Society; in as long ago as 1932 he took part in an expedition to Sarawak, the Oxford Expedition. In 1933 he gave his first lecture to the Society. In 1936 he was awarded the Cuthbert Peek Grant and, in later years, he has made Sarawak a centre of research. He has been well placed to do so, for he has not only been Government Ethnologist but also Curator of the National Museum. His activities, however, have not been restricted to ethnology, archaeology, sociology and the rest; during the war he was dropped behind the lines in this region, and as a result of his achievements received the D.S.O. This Society sponsors each year some twenty-five to thirty undergraduate expeditions; in 1955 there was one to Sarawak and in 1956 to North Borneo, so it may be understood we take a real interest in that part of the world. During the last ten years there have been great changes there, and Mr. Tom Harrisson is going to show us and tell us something about them. We have the great satisfaction of the presence this evening of the Minister of Education, Mr. Geoffrey Lloyd. I do not know whether we are to regard him as coming here firstly as Minister of Education—which he well might, for we take an active part in education in the geographical field, especially through our Education Committee; or whether he has come here because he was, not very long ago, in Borneo.

Mr. Tom Harrisson then read his paper

The PRESIDENT: I will now ask the Minister of Education, Mr. Geoffrey Lloyd, M.P., if he will say something.

Mr. GEOFFREY LLOYD said: During my welcome period of freedom some two years ago I thought I would go round the world, and eventually I found myself in Sarawak. I then began to learn what a remarkable man Tom Harrisson was and is; not only is he the Curator of the Museum in Kuching, he is the administrator of the two nationalized industries in Borneo which make a handsome profit. Mr. Harrisson is a distinguished modern example of the adventurous Englishman who goes out to different parts of the world and plays a part in the country in which he lives. It is

particularly encouraging that we can still produce this type because there was a time, for a year or two after the war (perhaps as a sort of revulsion from those times), when I feared British people were becoming insular in the bad sense. Their interests seemed to be all flowing inward, and there did not seem enough adventure and enterprise and people going out into the world. I think it was in 1947 or 1948 when I visited New York that I had for the first time the impression that the Americans had a greater knowledge of the world than we had. But now the tradition of adventure and enterprise is coming back to our islands, and Tom Harrisson is a magnificent example of it.

The PRESIDENT: When I first came across Tom Harrisson many years ago he had developed a new technique called "Mass Observation" in this country, and today he has shown how he has developed this meticulous system of observation in Borneo and Sarawak. We are greatly indebted to him for coming tonight, a Fellow of our Society to address his fellow members.

EXPLORATIONS IN PATAGONIA

ERIC SHIPTON

NO ONE WITH a taste for strange country can fail to be impressed by the remarkable geography of the Andes of Southern Patagonia: the labyrinth of fjords which split the Chilean coast and bite deep into the mainland; the curiously similar pattern of lakes on the opposite side, many of which, Lagos San Martin and Buenos Aires for example, though lying well to the east of the main range, are drained by rivers flowing through it into the Pacific; the innumerable glaciers which radiate from the central ice caps and thrust their massive fronts into the intricate system of waterways surrounding them. That so much of the region remains unexplored is due almost entirely to its physical difficulties, for during the last sixty years many attempts have been made to penetrate it. Most parts of the main range, even on the eastern side, can only be reached by amphibious operations which are liable to be rendered hazardous by the violent and prolonged storms which prevail. The glaciers in their lower reaches are often so broken and crevassed that it is impossible to travel on them; lateral moraines rarely offer an easy line of approach, and the forest, which covers all but the steepest slopes and extends to an altitude of about 3000 feet, is usually dense, trackless and difficult to negotiate. Except on parts of the ice caps where sledges might possibly be used, back-packing is the only means of transport, and no porters can be hired locally to help with this. But the chief problem is presented by the prolonged periods of rain, the rarity and brevity of spells of fine weather and, above all, the savage wind-storms which sometimes continue for weeks at a stretch, with gusts up to 130 m.p.h. It is these obstacles which have prevented most expeditions from achieving more than a very limited objective or covering more than a very small portion of this very large and exceedingly complex field. The redoubtable Salesian priest, Alberto de Agostini, has been a dominant figure in the exploration of the region. He has led no fewer than twelve expeditions to various parts of it, which have contributed the major part of our knowledge of the main range. A few of the high mountains have been climbed, notably the formidable peak of Fitzroy, the ascent of which was made in 1952 by a French expedition led by Lionel Terray. In 1956 H. W. Tilman and two companions crossed the range from the Calvo Fjord to the front of the Moreno Glacier on Lago Argentino.

The chief objects of the small expedition which I took to the Patagonian Andes during the 1958/59 season were glaciological and botanical. Geoffrey Bratt, who had been with me in the Karakoram the previous year, shared both the initiative and the organization. He planned to make large-scale surveys of various glacier fronts which would serve as a basis for later observers. We invited John Mercer, who had already been twice to the area in which we proposed to operate, to join the party. He was anxious to continue a line of study on the trees bordering the glaciers, designed to ascertain the dates of successive glacial advances. The Trustees of the British Museum lent us the services of Peter James to make a comprehensive collection of plants and lichens, and furnished a grant of money to cover his expenses. We also invited Peter Miles to join us in Argentina to act as liaison officer and to make collections of birds and insects. Besides the British Museum, grants were also received from the Mount Everest Foundation and the Percy Sladen Trust, and surveying

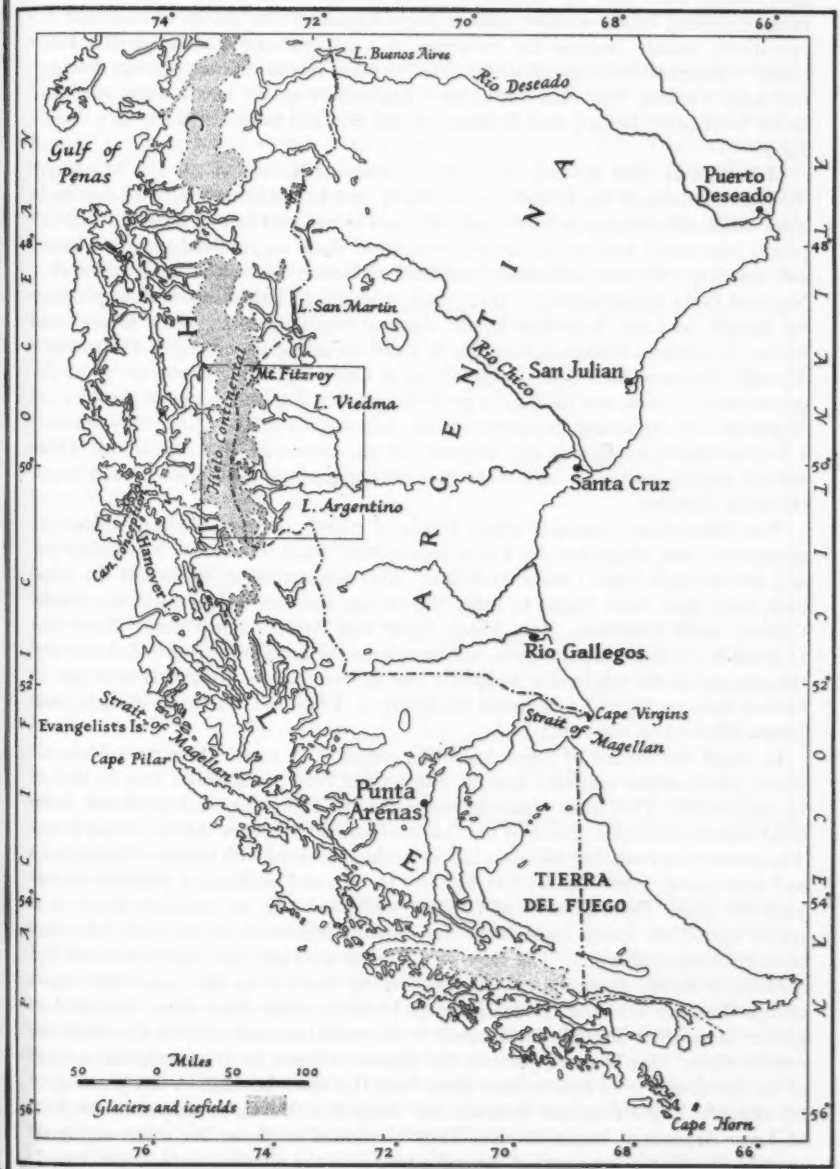

74°
72°
70°
68°
66°
L. Buenos Aires
Río Deseado
Gulf of Penas
CHILE
ARGENTINA
Puerto Deseado
48°
L. San Martin
Río Chico
San Julian
Mt. Fitzroy
L. Viedma
Hielo Continental
50°
Santa Cruz
L. Argentino
Can. constance
Hanover I.
Rio Gallegos
52°
Strait of Magellan
Evangelists Is.
Cape Pilar
Cape Virgins
Strait of Magellan
Punta Arenas
TIERRA DEL FUEGO
54°
50 0 Miles 50 100
Glaciers and icefields
Cape Horn
56°
76°
74°
72°
70°
68°
66°
PACIFIC OCEAN
ATLANTIC OCEAN

Figure 1

instruments were lent by the Royal Geographical Society. The section of the range embraced by the western arms of Lago Argentino was chosen as our field of operations, mainly because the existence of a government launch on that lake makes it comparatively easy of access. We intended also to visit the glaciers flowing into Lago Viedma. Our plan was to leave England by sea on 1 November 1958, to spend December, January and February in the field and to return home on 9 April 1959.

Miles met us when we arrived in Buenos Aires on November 23. Dr. MacKay, the representative of the British Council there, and his assistant Mr. Whistler, had made admirable arrangements for our stay, and introduced us to a large number of people who could help or advise us; from all of these we received great kindness and courtesy. We are particularly indebted to Senor Tortorelli, Director of the National Parks Administration, who among other things issued instructions placing the launch on Lago Argentino at our disposal when we required it. James was invited to attend a botanical congress in Cordoba at the beginning of December. Though this involved a delay in his arrival at Lago Argentino, it was too good an opportunity to miss, and he spent a profitable week being introduced to the flora of Argentina by Argentine botanists. Shell Argentina Limited generously placed a Kayser station-waggon at our disposal for the period of the expedition. This vehicle proved invaluable, and without it our programme would have been considerably curtailed.

The bulk of our baggage, which consisted mostly of the botanical collecting equipment, was dispatched by a ship sailing from Buenos Aires on November 29 and due to reach Santa Cruz a week later. This was a mistake, for in fact the ship took more than three weeks to make the voyage and our baggage did not reach Calafate until Christmas Eve. Miles, Bratt and Mercer left Buenos Aires on December 1 in the station-waggon and completed the 2000 mile drive to Calafate by the evening of the 7th having stopped a day in Commodoro Rivadavia to repair a broken main spring and a shattered wind-screen. I flew to Calafate on the 4th, and James followed on the 11th.

In shape the outline of Lago Argentino resembles a squid. The main body of water, which drains eastward into the Santa Cruz River, is 40 miles long by about 15 miles wide. Two main channels run westward from this, and subdivide into eight sinuous tentacles. Some of the fjords so formed are more than 30 miles long. The country surrounding the main lake is treeless, covered with coarse yellow grass, and rises gently from lake level at 600 feet to hills and undulating plateaus about 3000 feet high. The little town of Calafate, which lies near the southern shore, is a centre for all the sheep *estancias* in the district. Westward of the main lake the country changes abruptly. The sides of the fjords are steep and largely covered by nothofagus forest. Several large glaciers flowing down from the main range discharge their ice into the fjords; icebergs breaking away from these spectacular glacier fronts drift through the channels to the main lake and occasionally reach its eastern shore. One of these glaciers, the Moreno, thrusts its front right across one of the fjords and from time to time dams back the water beyond. A few years ago, for example, Lagos Rico and Roca and the Brazo Sur (the three southern branches of Lago Argentino) began to rise. They continued to do so for some eighteen months, flooding a large part of several *estancias* in the vicinity, until it was feared that the water would flow across a neck of land to inundate the village of Punta Bandera on the main lake. Fortunately before this happened the ice dam burst, and twenty-four hours later the water of all three arms had retreated to its normal level.

Various theories, none very convincing, have been advanced to account for the curious fact that of all the glaciers in the region, the Moreno is apparently the only one not in a state of active retreat.

Our rough plan was first to establish a base somewhere on the shore between Lago Onelli and the front of the Upsala Glacier at the north-western extremity of the lake and to work from there for four weeks; secondly, to spend a similar period at the head of the Seno Mayo further south; and finally to move over to Lago Viedma to spend the rest of our time about the glaciers at its western end. This plan was modified, partly to give James a wider and more varied field for collecting and partly to meet a number of unforeseen contingencies, the first of which was the late arrival of our main baggage.

Mr. and Mrs. Percival Masters and their son Herbert had invited us to visit their *estancia*, La Cristina, at the head of one of the north-western arms of the lake. This remote spot is accessible only by many days of rough marching across the mountains to the east, or by boat from Punta Bandera. When Mr. Masters originally came to Lago Argentino to settle he brought a lifeboat salvaged from a wreck off Punta Arenas. Though this was later replaced by a small steam launch capable of making the voyage to Punta Bandera in six hours, this is only possible in fairly fine weather, and often for several months at a time the Masters have no physical contact with the outside world. Herbert Masters, however, is a skilled radio amateur and he maintains daily wireless contact with Calafate and various *estancias* in the district. When I reached Calafate I spoke to him by radio and he told me that he and his parents were awaiting our arrival before coming out for their annual visit to Rio Gallegos. So, the party having reassembled, we were taken over to La Cristina by December 14. Unfortunately for us the launch had to return to Punta Bandera the same day and the Masters had to take the opportunity of going with it, so that we only had a few hours in company with our hosts. They were extraordinarily kind and seemed to regard it as the most natural thing in the world that in their absence we should make free use of their house, their launch and all the facilities of the *estancia*.

Figure 2

La Cristina is beautifully situated near the lake shore at the southern end of a wide valley. This is flanked on the east by forested slopes rising in a series of terraces to a range of barren mountains which, though 6000 feet high, lie beyond the zone of heavy precipitation and hold very little permanent snow. The head of the

valley, dominated by the sharp spire of Cerro Norte, is filled by a lake some five miles long. To the west, the valley is contained throughout its whole length by a ridge, similarly forested and terraced, about 2000 feet high. These terraces, which cradle a score of small lakes, are formed by old lateral moraines, and mark the successive stages in the retreat of a glacier which not so long ago (geologically speaking) filled the valley and was once united with the Upsala Glacier. The crest of the ridge commands a superb view of that vast ice stream; westward across it to a splendid panorama of peaks of the main range; southward to where it plunges its massive front into the waters of Lago Argentino; northward in an ever widening sweep to the continental ice cap and the mountains of the Mariano Moreno range, more than forty miles away.

The survey instruments and most of our camp equipment had been brought with us, so that a start could be made with the field-work. It was decided that James and Miles could most profitably spend the ten days until the government launch returned, collecting in the vicinity of La Cristina; particularly as James, lacking most of his equipment, was faced with the problem of drying and storing his specimens without it. I stayed with them. On December 16 Bratt and Mercer were taken in the steam launch to Onelli Bay where they landed some food supplies, and then on to a point along the same shore about three miles from the front of the Upsala Glacier, where they were deposited with their food and equipment. They spent the next two weeks working in this area.

Miles, James and I returned to Punta Bandera on December 23, and that evening drove out to Estancia Lago Roca where we were welcomed by Mr. and Mrs. Atkinson. They immediately invited James to make his headquarters there for as long as he liked. This wonderful offer was accepted and it was decided that he would spend the next fortnight making a botanical survey of country surrounding Lago Roca and the mountains to the south. With the transport and other facilities placed at his disposal he was able to cover a wide area. We were extremely fortunate, not only in the delightful hospitality we received then and later, but also in the fact that both Mr. and Mrs. Atkinson were keenly interested in natural history and their knowledge of the flora and the birds of the region was of great value to James and Miles. The following evening our baggage arrived in Calafate; Miles and I spent Christmas Day unpacking it and transporting James's collecting equipment to Lago Roca, and on the 26th we were taken in the launch to Onelli Bay.

We landed on a broad spit of forested land separating Lago Onelli from the main lake and here we established our "Onelli Base." Many years ago Mrs. Masters's brother had made a bold attempt to establish an *estancia* at this point for the purpose of breeding cattle; but he had abandoned the project together with much of his stock. As a result the surrounding forest is inhabited by wild cattle and horses, which are confined to fairly narrow bounds by precipices and glaciers. Within these bounds, however, they have trampled a network of tracks, which are a great help in moving about the forest. On the 27th we made our way to the eastern shore of Lago Onelli and from there climbed a prominent hill which gave us an excellent view of the surrounding country. The lake is three miles long and nearly two wide; it drains into Onelli Bay by a short but wide and rapidly flowing river. The whole of the western and north-western shores of the lake are occupied by the fronts of two great glacier systems, which join a mile beyond the lake. The western ice stream enters the lake as a low, comparatively smooth tongue, but the northern front presents a continuous cliff of ice standing more than 200 feet above the water. From our view-point we watched huge blocks of ice calving from this cliff and falling into

the water with an impressive roar. The waves started by these avalanches spread right across the lake, though as they reached the opposite shore they appeared as no more than ripples. Later we discovered that this was not quite the case. The blocks of ice breaking from the glacier fronts drifted down the lake and pushed themselves into a confused mass at its eastern end.

We saw that there was no feasible way round the northern side of Lago Onelli; on its southern side there was one point where the precipice fell sheer into the water, and though it might be possible by climbing some thousands of feet up through the forest to get round this, it would have been a very long and laborious operation. We had brought from England an inflatable rubber boat, about 8 feet long, and a "Seagull 40" outboard motor. That evening, back at Onelli Base, we assembled these and went for a cruise in the Bay to try out the boat. The following morning we carried it, together with 80 pounds of food, through the forest to a point on the northern shore of Lago Onelli from where we could see a lead through the ice-bergs. We rowed the boat cautiously through this until we reached the clear water beyond. Then we started the motor, set a course for the south-west corner of the lake and sat back to enjoy ourselves. It was a perfect day, cloudless and still. The blue water and the dark green of the forest, fringed with emerald at its upper limit, contrasted beautifully with the immense cirque of glaciers and ice mountains which opened swiftly to our view. We watched several avalanches falling into the lake from the glacier front, but the great waves they caused had so broadened by the time they reached us that we did not feel them. At the south-west corner of the lake we found a little cove partly enclosed by the lateral moraine of the Onelli Glacier which projected far into the water. Bordering the cove there was a grassy glade covered with flowers, and sheltered on two sides by the forest and on a third by the high ridge of the moraine. We landed the stores at this delightful spot, which later became known as "Pedro's Camp."

On the return trip we cruised for a while along the northern and southern shores. When we reached the packed icebergs towards the eastern end of the lake we found that the lead through which we had come that morning had widened, so instead of stopping the motor and getting out the oars I merely throttled it down to a slow speed. As we drew near to the point where we had embarked we reached a narrow channel between two bergs. I was just about to stop the engine when we struck a submerged ledge of ice; the motor was wrenched from its fastening and I turned in time to see it sink slowly beneath the surface and disappear. By now we were only about ten yards from the shore and I thought at first that we were in shallow water, which however was too charged with glacier mud to see more than a foot below the surface. I scrambled out onto the nearest berg and stayed there to mark the spot while Miles went ashore and returned with a twelve foot pole. To our dismay we found that even with this we could not touch the bottom. The ice of the berg I was standing on shelved gently below the surface for about two yards which accounted for the fact that the motor had sunk so slowly. We saw, too, that the berg was drifting so that it was no longer possible to identify the exact place where the accident had occurred, now probably somewhere under the ice. There was obviously no hope of recovering our precious motor.

When we got back to Onelli Base we found that Bratt and Mercer had arrived overland from their Upsala camp. They had left most of their equipment there, so the next day, while Bratt did a high survey station and Miles started his collecting, Mercer and I took the boat round the coast to fetch it. The twelve mile row gave me ample cause to lament the loss of the motor; but again the day was fine, the

water calm and the scenery very beautiful. Indeed we were enjoying a spell of fine weather very rare in the Southern Andes: during the fortnight that we spent around Lago Onelli we experienced only a few light rain storms and there was no wind to speak of. After rounding the northern point of Onelli Bay we passed close to a number of very large icebergs drifting down from the Upsala Glacier front, some worn into fantastic shapes, others with cliffs and caverns of unnatural blue. Sometimes weird noises would emanate from one or other of these monsters; it would begin to pitch like a ship in a rough sea and occasionally the whole mass would turn turtle.

When we returned that evening the party was ferried in three relays across the mouth of the Onelli river, and from there we carried the boat and our equipment through the forest to the south-west corner of Lago Onelli where we camped at 11 o'clock as night was falling. The next morning the other three made their way along the southern shore while I took the equipment in the boat. I rowed to a point just beyond the vertical cliffs, unloaded the equipment onto some rocks a few feet above the water and returned to fetch the others. While I was rowing Mercer around the impassable section we heard an avalanche fall from the glacier across the lake. Five minutes later we reached the place where I had dumped the loads and found that a heavy swell was beating against the rocks where they lay and all but washing them away. We had to stand well off the shore, or the boat would have been ripped on submerged rocks now revealed by the backlash of the waves. At length the swell subsided and we were able to land and carry the loads to a safe place in the forest above. But we were lucky to escape the consequences of my carelessness, for when the last man had been brought across and while we were reloading the equipment into the boat, we heard a prolonged roar from across the lake and we watched a whole series of seracs collapse and crash into the water. We hastily unloaded the boat again and carried it and the equipment well clear of the lake. Five minutes later the waves came; this time they were many times larger than before and completely submerged the rocks where I had originally dumped the loads. The lesson was well and cheaply learnt. We reached Pedro's Camp in the middle of the afternoon.

During the next two days, while Bratt was busy surveying the main glacier fronts, Mercer and I took a camp across the Onelli Glacier to collect tree sections and to climb to a high ridge dividing the two glacier systems which offered a splendid view of the whole area. We found the forest so dense that we realized that the latter project would take all our time, and after a brief struggle we gave it up and camped near the edge of the glacier, half a mile above the junction. The nothofagus here were unusually large, fully 80 feet high so far as we could judge. It seemed strange to be sitting in the dark shade of these ancient trees, looking out across a huge expanse of ice, riven and twisted, dazzling white. Another thing that never quite lost its strangeness for me was the sight of flocks of parrots flying over those glaciers, uttering the same raucous cries that hitherto I had associated only with Indian jungles and such places. By far the most common birds in the forests were wrens; they used to perch a few feet away to scold us wherever we went. A specimen also much in evidence was a woodpecker, the male of which was crested with a beautiful red cockade.

On 2 January 1959 Bratt, Mercer and I set out to attempt a peak which we hoped would give us a view across the main continental watershed. We made our way along the Onelli Glacier for several miles and crossed it to the foot of the last of several spurs dividing its northern tributaries. Climbing the steep, forested slopes

was strenuous work, particularly higher up where the twisted boughs and stems of dwarf nothofagus, far too tough to break, were closely intertwined, and it was eight o'clock by the time we had reached the upper limit of this scrub and had found a suitable ledge on which to pass the night. According to our aneroid the altitude was 2800 feet, which seemed a very paltry height to have reached after a long day's toil. But for all that, our bivouac commanded an extensive view, and with three hours daylight still in hand, we had ample leisure to enjoy watching the sunset colours spreading over a wide expanse of glacier, lake and sky.

We started at 7 o'clock the next morning, climbed up easy slopes for 1400 feet, and at 8 we reached the first steep buttress of the ridge. Mercer had injured his arm a few days before and decided to turn back, while Bratt and I roped up and continued. For the next two thousand feet the ridge was steep and narrow, but though the rock was far from sound, it did not present much difficulty. To our left we looked into a great ice amphitheatre forming the head of the Onelli Glacier. In the centre of this there was a broad glacier saddle about 7000 feet high, which evidently lay on the main watershed. To our right was a sheer drop to a tributary glacier fed entirely by ice avalanches falling from the mountain. At a height of about 6500 feet our ridge ran out into a snow slope. Though not particularly steep its surface was most unstable. It was composed of balls of ice about the size of large glass marbles which slipped like scree beneath our feet and threatened to carry us down with it over the precipice below. At first we could make nothing of it, but soon we found that we could cause the first few layers to avalanche and then cut steps in the comparatively compact layers beneath. At length we reached a bergschrund below the summit ridge of the mountain. This was backed by a formidable ice cliff, about 20 feet high, which we surmounted only after an hour and a half of very difficult climbing. The ridge beyond, however, was broad and easy, and two hours later, at 4.15, we reached the summit. The aneroid showed the height as 8100 feet. To our surprise we found we were standing on the continental divide, which in this part of the range bears no resemblance to an ice cap. The weather to the west was not as clear as we might have wished, but looking down across the Onelli saddle we could see the dark forests of the Pacific coast broken by a narrow arm of water, which must have been the upper part of Penguin Sound. The country to the north-west fell away gently in a wide glacier valley which looked very bleak and inhospitable. The eastern half of the view, though less interesting to us, was much more spectacular. We allowed ourselves half an hour before starting to descend. I spent too much of our valuable time climbing down the ice cliff, but Bratt made up for it by a terrifying and not altogether voluntary leap. It was nearly 10 o'clock before we reached our bivouac.

The next morning we climbed down to the "Avalanche Glacier." Glaciers of this type seem to develop in a curious pattern: below the limit of the avalanche debris the ice forms into a series of sharp longitudinal ridges with deep clefts between, spreading symmetrically outwards so that the front of the glacier (in this case its junction with the Onelli) resembles an opening fan. We tried to make our way down the ice, but we found that the ridges became far too sharp and the chasms between much too deep. That evening we joined Mercer in a camp on the southern side of the Onelli Glacier, and spent the next day visiting the great amphitheatre at its head. On returning to Pedro's Camp Bratt and I took some soundings in the lake. About half a mile from the front of the calving glacier, which was as close as we dared to go, we found a depth of 450 feet. On January 8 we were picked up at Onelli Base by the government launch and returned to Calafate. I had intended to

collect further supplies of food and to proceed immediately to our next base at the head of Seno Mayo, the westernmost arm of Lago Argentino. The launch, however, had developed engine trouble, and it was necessary to defer this project for some three weeks. Meanwhile Bratt, Mercer and I travelled in the station-waggon to Lago Viedma and Miles and James went south-westward to the head of the Brazo Sur and beyond to Lago Frio.

Since the discovery of the great lakes of southern Patagonia, there have been several reports of volcanic activity somewhere in the vicinity of the ice cap. For example, some of the early travellers described showers of volcanic ash falling near the western end of Lago Viedma. In 1934 a party led by Dr. Reichert attempted to cross the ice cap from the most southerly branch of Lago San Martin. Prolonged storms hampered their progress and restricted their views of the surrounding country, but shortly after they had turned back from their farthest point on the ice cap, the weather cleared for a short while and they saw a great volcanic cone standing above the ice, only three or four miles away, and emitting clouds of steam. Shortage of supplies however prevented their examining the phenomenon more closely. There was a still more definite report of a volcano on the ice cap some thirty miles farther south, this summary of which was written by Dr. L. Lliboutry in the *Journal of Glaciology* of April 1953 (p. 170): "Observing still confidential A.A.F. photographs of 1945, Professor Carlos Keller of the University of Chile, found a volcanic crater of 7.7 km.^{2} which was giving forth smoke in the accumulation area of the Viedma Glacier at the foot of the Mariano Moreno range. By kind permission of the Argentine Government we were enabled to fly over Monte Fitzroy when returning [from the French Expedition of 1952], and I distinctly saw the crater of ashes on a level with the glacier. It in no way resembled a nunatak, but was without any sign of volcanic activity. At the firn line there is an irregular brown marking which could not be explained by any moraine deposit, and is perhaps the evidence of a relatively recent eruption of ashes." Dr. Lliboutry suggested that this volcanic activity might account for the comparatively static condition of the glaciers of the region.

The first object of our journey to the Viedma area was to reach this "Vulcan Viedma," as it was called on some maps, so as to obtain definite proof of its existence. There is a fair earth-road running from Calafate to the eastern end of Lago Viedma, which involves the crossing of three ferries. The middle one of these was out of action, so that we were compelled to make a long detour to the east by a very rough pony track over the hills. On the way we saw a large number of guanaco (an animal resembling a llama) and rhea (the South American equivalent of the ostrich) and a few armadillos. The road along the northern shore of Lago Viedma is very rough, but it enabled us to drive as far as the Rio de la Vuelta near the north-west corner of the lake. We left our vehicle here and on January 13 walked the last 15 miles to Estancia Rio Tunnel which is owned by a Norwegian family called Halversen. They very kindly lent us a horse to carry our baggage and with this we made our way up the Rio Tunnel. Beyond a deep gorge this spread into a beautiful open valley of forest and pasture dominated on the north by a splendid array of peaks, including Fitzroy and Cerro Torre. Five hours marching on the 14th took us to a glacier lake beyond which we could not take the horse. I rode the animal back to the *estancia* and rejoined the others soon after dawn the following morning. Meanwhile they had reconnoitred a route through the glaciers blocking the head of the valley, and on the evening of the 15th we reached a pass, some 4300 feet high, leading directly onto the Viedma Glacier.

From this point the Viedma Glacier appears as a vast sheet of ice descending gently from the huge plateau of the Hielo Continental of which it forms a kind of lobe. It penetrates the eastern rim of the plateau as an ice stream nearly ten miles wide, contracts rapidly and reaches Lago Viedma, twelve miles to the east, with a front of about two miles. The general altitude of the plateau itself is about 6000 feet, but it is intersected by a number of ranges, of which the Cordon Mariano Moreno, stretching some fifteen miles from north to south and containing peaks up to 11,600 feet, is one of the most prominent. We had no difficulty in identifying the "Vulcan Viedma" lying close under the eastern flanks of this range; it looked like a long island standing above a sea of ice, and it was the only feature of its kind for miles around. We set out towards it, carrying enough food for eight days. Although the slope of the glacier was almost imperceptible, and its surface appeared from a distance to be perfectly smooth, we found that much of the surface was as broken as though it were part of an ice fall. We had to make a long detour to the east to find a reasonably easy route.

Three or four miles from the side of the glacier we came to a place where pumice was scattered over the surface of the ice in the form of an ordinary morainic deposit. It was rapidly decomposing; most of it had already disintegrated into a fine silt and the rest was so sodden that it was difficult to pick up a piece without crushing it. However we obtained several samples, which dried into firm lumps. Though the area covered by pumice was several miles wide, we found none anywhere near the "Vulcan," and it was clear that wherever it came from it was not from there.

We were lucky to have a spell of comparatively fine weather for the outward journey. As we went across the ice we watched dense banks of cloud pouring over the Mariano Moreno range from the west. So closely did they cling to the contour of the mountains, so sharply was their edge defined against the blue sky, that they might easily have been mistaken for part of the ice cap, but for their rapid movement as they cascaded across the main divide, plunged down the eastern side and vanished. We reached the "Vulcan" late in the evening of the 16th and that night the weather broke. Had it done so twelve hours earlier we would have had a very rough time trying to reach our objective. As it was we camped for the next three days under the lee of a massive boulder which, with the main ridge of the "Vulcan," gave us some protection from the storm. When we ventured away from this we encountered winds of extreme violence. The temperature was well above freezing point so that the driven snow melted as it came into contact with our clothing, and in a very short time we were soaked through.

However, we managed to make a thorough investigation of the "Vulcan." It is in fact an ordinary nunatak, 3½ miles long and perhaps a mile wide, composed mostly of sedimentary and metamorphic rocks. The highest point stands some 1500 feet above the glacier. There is a certain amount of grass and we collected about a dozen species of flowering plants. Near the middle of the outcrop there is a large lake-basin, which was obviously the "crater" mentioned by Lliboutry. It was empty when we were there but a series of shorelines and stranded icebergs showed that from time to time the water is dammed back by the ice on the southern side of the nunatak and floods the basin to a depth of about 400 feet. There are also half a dozen smaller lakes. We found no evidence whatever of any volcanic or thermal activity, present, recent or past. The only unusual feature of the nunatak that we observed was some exceptionally large melt-pits that had developed at various points between the ice and the rock. Some of these were about 100 feet deep. The

question of the existence of active volcanoes somewhere on the ice cap remains unresolved. Apart from the previous evidence, some of which our visit to the "Vulcan Viedma" had refuted, we must now account for the origin of the pumice that we found on the Viedma Glacier. I believe it to be most improbable that this comes from old beds of volcanic debris exposed by glacier action.

We had hoped to climb one of the peaks of the Mariano Moreno, which in reasonably fine weather we could have done with one camp above the "Vulcan." But the weather showed no sign of improving, so instead, we marched ten miles down the Viedma Glacier and spent two nights and a day in the forest on its right bank to enable Mercer to obtain tree-sections from the more recent lateral moraines. The rain and wind continued unabated and we awoke on the morning of the 22nd to find the forest white with snow. In foul weather we found our way back across the pass to the Tunnel Valley where we arrived drenched and hungry. We had intended to make a second sortie on to the ice cap, but this project was abandoned, and Bratt and I went round to the front of the Viedma Glacier to make a survey of it. We returned to Calafate on January 27.

James and Miles had returned to Estancia Lago Roca from their expedition to the south-west. They too had had a rough time with the weather, but this had not prevented them from adding valuable material to their botanical and zoological collections. They had been accompanied by two Argentine mountaineers, Barney Dickinson and John Cotton, whom I had invited to spend as much time with the expedition as they could spare. Unfortunately Cotton had to return to Buenos Aires at the beginning of February, but Dickinson was free to join us in the next phase of the expedition. By now the launch had been repaired and on January 31 we were landed with supplies of food for four weeks at the head of the Seno Mayo.

This is one of the most spectacular fjords of Lago Argentino. It lies between precipitous forested slopes, intersected by glaciers so steep that it looks as though a slight disturbance would cause them to plunge bodily into the lake. At the head of the fjord, overshadowed by the magnificent rock spire of Cerro Mayo, the valley is blocked by a great ice stream (the Mayo Glacier) which crosses it at right-angles and butts against its northern wall. Beyond this, the valley continues westward and bites so deeply into the main range that its actual head is only about six miles from the waters of one of the Pacific fjords. Apart from the botanical, zoological and glaciological work, our chief object was to find a way into the basin of the upper valley beyond the Mayo Glacier, to explore it and, if time and weather allowed, to cross the range to the Pacific side. We pitched a camp in the forest on a wide spit of land jutting out from the southern side of the fjord and this delightful spot acted as a base for James and Miles. But we found it impossible to reach the glacier from there, so on the following day I ferried the rest of the party with equipment and two weeks' food over to the northern side, an operation rendered so complicated by a powerful westerly wind that it took us most of the day. The wind was extraordinarily warm, which caused very rapid melting of all the ice surfaces. A vertical wall, rising straight out of the lake for 3000 feet and crowned with a glacier, was festooned with waterfalls; when the wind was strong these never reached the base of the cliff, for they were caught at various levels by the stronger gusts and sent swirling upwards so that the whole vast wall looked as though it were smouldering. These warm winds were invariably the harbingers of storm, and during the next few days the weather was very rough; indeed, during the four weeks that we were in the Seno Mayo there were only five days when it did not rain, and calm spells were rare. We were lucky enough to find a very large overhang under the

northern precipice, and in this we made a comfortable base, completely protected from both wind and rain.

The barrier formed by the end of the Mayo Glacier, though less than two miles wide, was much more formidable than we had expected; everywhere the ice was broken into a chaotic labyrinth of sharp ridges and spires intersected by deep crevasses. We made two attempts to find a way across, but our progress was so slow that each was abandoned before we had reached the middle. I was laid up for two days with influenza after which, on one of our few fine days, Dickinson, Bratt and I climbed to a prominent spur running down from Cerro Mayo. From there we looked down a vertical precipice of some 2000 feet to the lake beyond the ice barrier. We had a clear view of the southern section of the basin and of a fairly low gap leading westward to the Pacific. Southward we saw to the head of the Mayo Glacier where a curious sheet of black moraine lay right across the upper basin. We took two sets of angles from the ends of a base, to determine the position of this moraine and the level of the inner lake. Shore lines extended some two hundred feet above the surface of the water.

The ground beyond the bluff looked so precipitous that we decided to attempt a high-level route into the upper valley basin only as a last resort. The following day Bratt and I made another attempt to cross the glacier. We kept close to the rock wall against which the glacier front was pressing. Sometimes we were able to use rock ledges, and at one place we made a valuable advance of two hundred yards by passing through a tunnel under the ice. At length we reached a narrow inlet from the lake beyond, which lay between a mass of impassable ice cliffs and a sheer rock wall. The only chance of making further progress was by using the boat. But the inlet was so closely packed with small icebergs that we were very doubtful whether we could force a way through. However, we decided to make the attempt and the next day we returned with Dickinson, carrying our food and equipment and the boat. It was less than three hundred yards to the opposite shore of the inlet, but it took us four hours of very hard work to get there. Our main worry was that the boat would be punctured on some jagged edge of ice as we heaved the icebergs apart to make a channel, and chipped at submerged ledges with our ice axes. It was late in the evening when we landed and we just had time before dark to fill the boat with rocks to prevent it from being blown away by the wind and to scramble up into the shelter of the steep forest where we spent the night.

We had hoped to complete the journey to the head of the main valley mostly by boat so as to avoid crossing the numerous steep ridges and cliffs along the shore. But the force of the wind and the roughness of the lake made this impossible, and we were obliged to make slow and very laborious progress by land. While in the forest, of course, we did not feel the wind, but the noise it made was most impressive: the individual gusts swept down the valley with a roar like that of a major ice avalanche. But on the night of the 10th there was a lull and the next morning dawned calm. We had already abandoned the idea of attempting to cross the gap to the Pacific, and we now decided to seize the opportunity of the calm spell to make a long march to the head of the main valley and back without our loads. The main reason for this decision was that there was one section of the route where the use of the boat was unavoidable. This was the neck of a big lagoon into which the glaciers on the northern side of the basin flowed. Even if it had been possible to cross these glaciers, which we could see it was not, the detour involved would have taken several days.

We rowed quickly along the shore and reached the mouth of the lagoon by 9 o'clock. But by that time the wind had started to blow again, so that I could not

manage the boat with all three of us in it. Dickinson remained behind while Bratt and I went on together. We left the boat filled with rocks on the western shore of the lagoon and pressed on as fast as we could to the head of the valley. We found that here the vegetation was much more luxuriant and the trees much larger than any we had seen elsewhere; presumably this was because of the greater rainfall in the western part of the range. When we returned to the lagoon in the late afternoon the wind was blowing with great force and we had considerable difficulty in launching the boat. As soon as we removed the boulders holding it down, it was swept up like a kite dragging us along with it. Once on the water there was no need to row for we were swept over the waves like a leaf with no control over our direction. Violent gusts came alternately down the lagoon and down the main valley. Swirling spirals of spindrift warned us of their approach and as a rule we managed to turn the boat so that they hit us astern. One blast however caught us broadside on and we very nearly capsized. We narrowly escaped being swept into a bay packed with floating ice from which it would have been very difficult to extricate ourselves. There was a heavy swell beating against the eastern shore of the lagoon, and when we reached it we were hurled unceremoniously onto the rocks. Meanwhile Dickinson had found an alternative route back to our camp which saved us many hours of toil and further aquatic adventures. Reluctant to repeat the passage of the ice-filled bay we decided to attempt a high-level route back. Fortunately during the critical phases of this the weather was calm. But on the last day the wind was as violent as ever, and we had to move roped together even on easy slopes. At one point Dickinson was blown over and, in falling, injured his back. On the 14th we reached the Mayo base where we found James and Miles hard at work on their collections. James had reaped a rich harvest and was now approaching his total of four thousand specimens of lichens and flowering plants.

On the 15th Bratt and I set out to reach the head of the Mayo Glacier. Once again we plunged into the maze of seracs and ice ravines. It was exasperating work; hours of strenuous acrobatics resulted in little apparent advance, and it was impossible to choose a route for more than a few yards ahead. Fortunately the day was fairly calm, though this gave us cause to wonder what the return journey might be like in really bad conditions. It was late in the evening when at last we broke through to relatively smooth ice, and at 9.30, very tired, we reached an isolated patch of forest at the side of the glacier. For the next thirty-six hours it rained heavily and without stopping. The ground on which we had camped became the bed of a stream and our tent was flooded. Then, on the morning of the 17th, the weather suddenly cleared completely and for the next three days there was not a breath of wind and scarcely a cloud in the sky. First we went up to the head of the glacier to examine the strange transverse moraine we had seen there. We concluded that it had been formed by a colossal landslide from one of the neighbouring mountains. Then we discovered an easy pass to the head of the Ameghino Glacier, and climbed to the summit of a small peak above it, where for three hours we sat and gazed at a magnificent panorama of nameless mountains.

When the launch picked us up from the Mayo base at the end of February, Miles, James and I returned to Calafate to wind up the expedition and arrange for the transport of the collections, while Bratt and Mercer spent a week in Ameghino Bay, where appalling weather prevented their doing much work. Before returning to Buenos Aires by air James, Mercer and I spent a delightful few days in Tierra del Fuego as guests of the Bridges family. Miles and Bratt travelled back in the station-waggon by the western route along the foothills of the Andes.

DISCUSSION

Evening Meeting, 11 May 1959

Before the paper the PRESIDENT (The Rt. Hon. Lord NATHAN) said: Patagonia is the latest of the various regions of the world which Eric Shipton has visited and explored, and about which he has written to the interest and advantage of so many of us. Eric Shipton has not only been an explorer in East and Central Africa—five expeditions, I think—the Himalaya has known him far better. It was he who pioneered the way to Everest which was afterwards followed by John Hunt and his party in 1953. He has had a notable career as an explorer, he is an old-time Fellow of this Society, a former member of its Council, and also one of the Society's Gold Medallists. Today he is taking us all to Patagonia, by voice and in pictures.

Mr. Shipton then read his paper

The PRESIDENT: Ladies and Gentlemen, amongst our company here today is Mr. Basil Goodfellow of the Alpine Club and Chairman of the Mount Everest Foundation which, by providing money and equipment, made possible, together with the British Museum and the Royal Geographical Society, the expedition of which we have just heard.

Mr. BASIL GOODFELLOW: Ladies and Gentlemen: Eric Shipton, of course, is one of those rare people who is equally honoured by the world of mountaineering and the world of exploration. Of all mountaineers he has, I suppose, contributed more than any single man to exploration, especially in Central Asia. It has been fascinating to see this evening country which must be so very little known to anybody, even in this Society; it is certainly little known to mountaineers apart from the Fitzroy Expedition and the brief Tilman visit to that side of the range. It reminds me of the somewhat similar country of the South Island of New Zealand, with its difficult glaciers running through forest on the east side, and the rain shadow running off into sheep country. I may say that the nearest I have personally managed to get to seeing some of Eric Shipton's earlier country is when I had the good fortune to travel only two months ago in a Soviet jet aircraft at 10,000 metres straight over the Himalaya in the region of the Tibet-Ladakh border, and over Kashgar. I looked down at his former Consulate, and was filled with envy at the magnificent country through which Eric Shipton has travelled. I would like to say again how much we admire all he has done, and envy him for being able to keep on doing it!

Note: An account of Mr. Goodfellow's flight may be found on pp. 468–9 of this *Journal.—Editor.*

THE ANTARCTIC VOYAGE OF M.V. *THALA DAN*, 1958

PHILLIP LAW

FOR THE 1958 RELIEF of the Australian National Antarctic Research Expeditions' stations at Macquarie Island, Mawson and Davis, the Antarctic Division of the Department of External Affairs had chartered M.V. *Thala Dan* (Captain K. Hindberg) from the Danish firm of J. Lauritzen, Copenhagen.

The ship was taken on charter in Melbourne on 5 December 1957, and under the leadership of the author departed on December 7 to carry out the relief of the Macquarie Island station. Bad weather, an extensive building programme at the station, and the landing and installation of auroral radar equipment at an auxiliary observatory twenty miles further south made this a strenuous and difficult undertaking and the ship returned to Melbourne on December 28 to load for her Antarctic voyage.

On 3 January 1958, the Minister for External Affairs, the Rt. Hon. R. G. Casey, P.C., C.H., D.S.O., M.C., officially said farewell to the departing expedition before a large crowd of people and at 1715 hours the *Thala Dan* sailed from Melbourne for Lewis Island, Wilkes Land. Shortly after leaving, a stowaway was found hiding in one of the lifeboats and he was sent ashore before the ship left Port Phillip Bay.

The first task of the expedition was to set up an automatic weather station on Lewis Island, where I had first landed in January 1956. The equipment, manufactured in France by the Société Industrielle de Télécommande et de Télémécanique was designed to measure barometric pressure, temperature, wind speed and direction, and to radio the information once every six hours to Macquarie Island, Dumont d'Urville, Mirny and Davis.

The voyage south was uneventful. On January 10 we commenced depth soundings and crossed the Continental Shelf at position 64° 43′ S. lat., 133° 41′ E. long. That evening we moved into brash ice; snow started to fall and visibility became bad at midnight, so the ship stopped. There were large numbers of icebergs and bergy bits in the position where we suspected Lewis Island to be and better light was needed before we could proceed. The Captain called me at 0200 hours and said the visibility had improved but he could not see the island. I could recognize nothing either, because of the large number of bergs. We cruised eastwards without seeing anything resembling the island and when I found a small ice-capped islet which I remembered having previously seen east of Lewis Island I began to think we had come too far. The Captain thought so too. We therefore turned back and followed the coast westwards, keeping within a mile or two of the ice cliffs. I seized the opportunity to plot the coast, using the radar, and to take accurate soundings. We worked on until about 0430 hours, when we had reached within nine miles of the extreme bottom of the bay to the west of Cape Keltie and it was obvious that Lewis Island was not there. We turned back and I re-checked the soundings and the coastal plotting until we reached our starting point. Keeping very close to the continental ice cliffs we continued eastwards until finally we found our objective.

We anchored at 0915 hours and a party of us proceeded in the ship's motorboat to reconnoitre for a landing place. We chose a rocky ledge on the northern side of the island where the penguins come ashore. From here we proposed to carry the

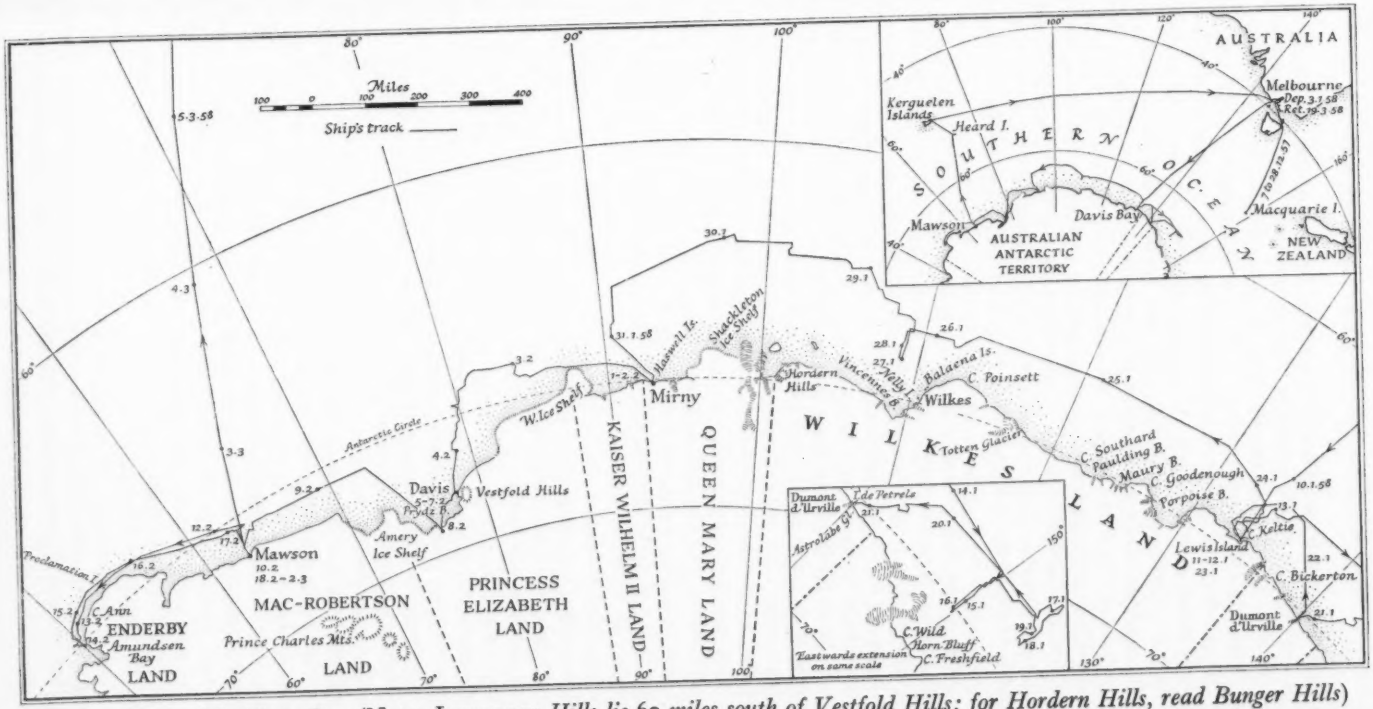


Fig. 1. Track of the Thala Dan (Note: *Larsemann Hills lie* 60 *miles south of Vestfold Hills; for Hordern Hills, read Bunger Hills*)

cargo up along a quarter-mile slope of snow which stretches from this landing point as a kind of penguin parade to the top of the island some 200 feet above sea level. I landed with Twigg to choose the spot for the automatic weather station hut while Thompson and Adams returned to the ship to commence unloading operations. Using a large rubber pontoon towed by motorboat they sent the first load of equipment ashore at 1030 hours. Old pontoon decking was used as a gang plank to connect the pontoon to the shore, while men worked with picks and shovels to clear the snow and make a reasonable platform above the rocks. Higher up the slope men commenced stamping down the snow to facilitate the transport of materials. Cargo then poured ashore in a steady stream, operations being assisted by a calm sea. After being landed, the cases were hauled up about 50 yards above the beach and dumped. Cook and Knuckey started magnetic and survey work while Twigg and Gardner set to work drilling rock holes and preparing the hut foundations.

The work of carrying 20 tons of cargo a quarter of a mile uphill through snow and over rough rock proved very exhausting and at lunch I felt sure we should need another day to shift it all. However, after lunch, as our techniques improved, things began to move more smoothly and a small toboggan sledge solved the problem of shifting the heavier lifts such as batteries and equipment cases. At about 1500 hours the last cargo was ashore and dumped above high water level and we concentrated on moving the stuff from this dump to another dump at the top of the hill, 50 yards short of the final destination. Although all the men were quite exhausted by the very heavy work, they made a great final effort to complete the job and by 2000 hours all cargo had been transferred to the hut site at the top of the island. In addition, the hut itself had been practically completed. Its roof was on but the final tying down had not been done. Altogether it was a splendid day's work. We returned to the ship and fell into bed at 2330 hours—for some of us the first sleep for 48 hours.

Next day, Sunday January 12, we rose at 0530 hours. The men completed the hut and assembled the wind generator, erected the 3-legged steel tower to hold it, and put up the radio masts. But the work was bottle-necked when both our rock drills, one of which was brand new, failed to work. By lunch time we had the old one going but the new one proved a permanent failure. After lunch I took all except eleven men off the Island, having decided to use the ship for a survey of the coast while work was continuing at the station. We sailed at 1345 hours and proceeded westwards on several long, straight, fixed courses for about twenty miles. By sketching radar pictures and accurately plotting the ship's course we were able to survey the coast and at the same time collect valuable soundings. This work, combined with what had been done the previous evening, provided a plot of more than 30 miles of this coastline. We returned to the anchorage at Lewis Island at 0745 hours on January 13. When we went ashore again in the pontoon we found that the weather had deteriorated and there was a nasty chop. A surge was rolling up on the rocks at our landing place and our pontoon was tipped on edge by a large swell, tossing White off into the water. He was rescued unharmed and we got ashore. We were lucky that the previous day had remained calm for the unloading period, as it would have been impossible under the existing conditions. Ashore we found that the men under Adams had done a very good job to complete the building. Leaving Twigg, Trigwell and Elliott behind to instal the equipment and test it during the next week, we brought the others on to the ship and sailed at 2200 hours.

I was very anxious to plot the large iceberg tongue which extends about fifty

miles from the coast just east of Lewis Island. We therefore proceeded through the night attempting to sail along the edge of this iceberg tongue. However, the solid phalanx of icebergs was so dense that we were forced time after time to move north and west. It appears certain that the tongue provides an impenetrable barrier for any ship. It was a night of magnificent scenery. First, in the dim twilight at midnight, we were hemmed in on all sides by great tabular icebergs; then shortly after two o'clock the sun rose, and immediately the scene changed from one of mystic grandeur to one of sparkling brilliance. Finally we passed from the iceberg region and headed north through very open pack. At 1400 hours we passed the northern limit of the great consolidated iceberg tongue and headed eastward in calm weather towards the Cape Freshfield region. On Wednesday January 15, at 0100 hours, we turned south along the 150th eastern meridian of longitude. At 0230 hours we met pack ice and at 1700 hours ran into a large open lead, trending south, along the western edge of a giant 60-mile iceberg which appeared to be stranded on the Virik Bank. Thus commenced one of the finest scenic days I have had.

We sailed through massed, domed icebergs. At first we tried to keep close to the giant iceberg on our port side and several times squeezed through narrow gaps only a few hundred yards wide between it and other large bergs encroaching from the west. At last, however, we were forced to detour because bergs from the west were wedged hard up against it. The weather was calm but foggy and we pushed on between domed icebergs whose tops were hidden in the mist and whose sheer ice cliffs loomed eerily up out of the fog to slide silently past into the gloom. It was a world of utter fantasy—penguins porpoised amongst ice floes on which basked numerous crab-eater seals, while whales surfaced and dived. Flocks of snow petrels wheeled above and Wilson storm petrels pecked at the oily-calm surface of the sea. The bergs crowded more and more closely until finally we were surrounded in an area of water so completely jammed with bergs that there were only two gaps—one through which we had entered, and one to the west to which we were forced to return to exit. From there we zig-zagged between numerous others, until finally at about 1400 hours we ran out into an open pool with bergs and pack ice on each side and solid consolidated pack barring further progress at the southern end. When we stopped at 1500 hours the water was becoming deeper and it appeared that we were on the southern edge of the Virik Bank. The soundings we had obtained on our run south had delineated the western edge of this bank. The depth over most of it had remained constant at approximately 280 metres, the bank having been planed flat by countless icebergs over thousands of years. As further progress was impossible I decided to put up the Beaver aircraft to see if we could cut our way through to the east without retracing our steps. The plane was hoisted out at 1710 hours and made a successful flight with Groves and Wilson, although the mist was low and they had to fly most of the time at 300 feet with poor visibility. They landed at 1840 hours and informed me that they had fixed the southern edge of the giant berg and found roughly the extent of the Virik Bank in a north–south direction. To the east they found progress barred by solid pack and bergs but there appeared to be possibilities to the west.

Next morning, Thursday January 16, I rose at 0300 hours and looked at the weather. It was not very promising but I decided to carry out a photographic flight over the Cape Freshfield area. Piloted by Wilson we took off at 0534 hours and at 0651 hours we were over Cape Freshfield. Turning westwards we started a camera run but had to stop after only a minute because low clouds swirled out from the plateau beneath us. We returned again to Cape Freshfield and this time

ran for seven minutes, covering part of the ice-cliff coast between Cape Freshfield and Horn Bluff. However, once again cloud descended from the plateau and forced us to stop our cameras. We were now flying at 3000 feet altitude in swirling white mist through which we gained an occasional glimpse of Horn Bluff. I switched on the aerial cameras just as we reached the Bluff and heard them ticking as the great dark-red rock cliffs, sheer and vertical for 1000 feet, reached up at us menacingly through the clouds of fog. Immediately after crossing the cliffs we were caught in violent down-draughts, so Wilson peeled off and dived to starboard for the coast. As we crossed the coast again I stopped the cameras and Wilson headed for the ship. When we had gone some miles, I looked back and found that Horn Bluff was again clear of cloud, so I persuaded Wilson to return to allow me to sketch the area even if we could not photograph it. However our luck was out. Just as we reached it and I again switched the cameras on and started sketching, the cloud rolled in, so I reluctantly gave up the whole project and we returned to the ship, landing at 0900 hours.

This flight had shown that 100 miles of heavy pack ice separated the ship from the coast and that there was no possibility of us proceeding any further south in the *Thala Dan*. We found also that Cape Freshfield was no longer an extensive ice point. It appeared that the point of the Cape had broken off and drifted away as an iceberg. From the foot of Cape Wild we had seen a great expanse of bay ice pushed forward to the north, making it appear almost as though Cape Wild were an inland mountain range. On our run back to the ship we flew over another giant berg at least 20 miles long and 5 miles wide. As soon as we landed, the aircraft was hoisted aboard. This was just as well, because a few minutes later the Captain noticed that our lead was rapidly narrowing as the large floe one mile wide, to which we had moored overnight, drifted eastwards towards a large iceberg. He started the ship immediately and we passed through a narrow gap into wider waters only several minutes before the gap closed and the floe ice, under pressure, slid up in cracked pieces onto the sides of the iceberg. Some men whom we had left making magnetic observations on the large ice floe were left to walk one mile across the floe to rejoin the ship on the other side. When they were on board we immediately set sail, retracing our path 70 miles northward to open water. At 2240 hours we pushed out of the pack ice to the north of the giant iceberg and headed east and north-east. I had decided to go further to the east to make another attempt to reach the coast in the region of Oates Land.

Friday, Saturday and Sunday proved to be the most frustrating days of the whole voyage. The weather was uniformly bad, with northerly winds, heavy fog and snow showers. Because of the weather it was not possible to put up the aircraft and the visibility was so bad, even from the crow's nest, that the Captain was not able to see far enough ahead to choose the easier routes through leads and broken ice. During these days he spent at one stretch more than 36 hours in the crow's nest, practically without respite. After much weaving and turning, in attempts to find a way into the ice, we pushed south through heavy pack until finally at our southernmost point our speed was reduced to less than one knot, at which stage progress was so slow as not to be worthwhile. There was no question that, with more time at our disposal, we could have pushed on towards the coast and it is possible we might have reached within striking distance, but it would have meant at least a week of work, with a corresponding amount of time to return, and we just did not have that time at our disposal. I was therefore reluctantly forced to give up this area and, in fact, we had a considerable struggle returning to open

water, in the vicinity of the Virik Bank. We reached this open water at 1545 hours on Sunday January 19, proceeded north-west to the 55th parallel, then headed westwards.

Monday January 20 was a very rough day with a 40-knot gale. At 1500 hours we turned south-west to run down to Dumont d'Urville station in Terre Adélie and at 1530 I spoke to the French leader, Rouillon, on the radio. He said that at his station it was blowing 60 knots and that their ship *Norsel* had left the anchorage to shelter behind an iceberg. He did not think it would be possible for us to approach and his meteorologists did not expect the weather to improve for forty-eight hours. I told him we could not afford to wait so long; however, I was prepared to continue my approach and if necessary to wait until noon the next day, but not later. As we approached the coast on Tuesday January 21 the swell flattened out and things began to look better. When we reached the tip of the Astrolabe Glacier the *Norsel* came out to meet us and escorted us back to a safe anchorage about one mile off Île des Pétrels. We anchored at 1405 hours to the accompaniment of loud explosions set off by the expedition men ashore. Our 32 men went ashore on a rubber pontoon although it was still blowing 25–30 knots. We landed at a small cove choked with ice on the southern side of the expedition's island. Here Major Petitjean took me up in a helicopter to photograph the station, but unfortunately the weather conditions and light were not what could have been desired. After that we inspected the main station. This constitutes quite a technical achievement. Because of the very rough terrain the main huts are built on platforms supported by scaffolding made of iron piping sunk into the rock. At the station our whole party was entertained to drinks by the French, then 13 of our men stayed ashore for dinner. The rest returned to the ship taking 15 Frenchmen with them. After dinner the party lasted until 2330 when we walked down to the beach. There we boarded our pontoon and went back to our ship, exchanging hilarious farewells with the returning French party on the way.

The *Thala Dan* sailed from Dumont d'Urville station on Wednesday January 22 at 0335 hours. Immediately echo soundings were started and the ship ran north for 12 miles before turning on a set course of 325 degrees. Later we turned westwards and headed for Lewis Island, which we reached on Thursday January 23 at 2300. Inside five minutes the pontoons were hoisted outboard and eight of us went ashore. We found the three men there in excellent spirits. They had enjoyed their stay and had done a lot of valuable work. They were quite satisfied with the equipment except for the master pendulum clock, which was stopping intermittently. We spent several hours attempting to find the trouble but, as time was going and the ship was waiting to sail, some drastic action had to be taken. I decided that the escapement was not properly adjusted and found that by tilting the clock out of the perpendicular it was possible to improve the performance. We could see no other method of approaching the difficulty so I finally made this adjustment and hoped that it would continue to work. We waited a further $1\frac{1}{2}$ hours and as the clock still kept going, though previously it had stopped every few minutes, I felt reasonably confident that it would be able to continue working. We therefore left and went back to the ship. (One year later this clock was still going!)

While I was ashore I had arranged for the aircraft to make a flight over the Dibble iceberg tongue to find its full extent. Actually two flights were made: the first one to adjust the radio instruments and the second one for a photographic flight over the iceberg tongue. The aircraft took off at 1222 hours on the second flight and landed at 1411 after a flight in which low cloud spoiled the last twenty

minutes of the photography of the tip of the tongue. We were all back on board at 1700 and the ship sailed at 1830 hours.

We proceeded due west again to check the coast and to take soundings beyond the point where we had plotted this particular coastal area. However, off Cape Keltie, we were driven north by obstructing icebergs and as we proceeded we had to divert eastwards practically into our incoming track in order to find our way to the open ocean through large ice floes and pack. It was surprising how much pack ice had drifted across to block our exit. We started to push heavy pack at 0200 on Friday January 24 and from then until 0900 the Captain worked the ice continuously. Open water was reached at 0922 and we headed west again. The weather remained remarkably calm and at 1445 hours on Sunday January 26 we turned south to make a direct approach to Vincennes Bay and the American base at Wilkes. At 1500 we met the ice edge and I decided to have a look at it from the air. Sandercock acted as pilot and we took off at 1556, setting course due south. We flew about 130 miles to Nelly Island which we had visited in 1956. The pack to the east of our flight was consolidated but I was able to plot a possible path through pack on our westward side which appeared to be reasonably negotiable. From Nelly Island we flew over to Wilkes Station, off which lay USS *Arneb*. We made four circuits of the station at low level and I took photographs. We then flew back to Nelly Island and proceeded 15 miles further west before turning north to return to the ship. Half an hour later we flew over the ice-breaker USS *Burton Island* which was on its way to Mirny. On the way back to the ship I sketched icebergs and measured distances and directions so as to be able to direct the Captain through the most negotiable ice. We landed at 1900 and, as soon as the aircraft had been hoisted on board, the Captain took the ship south into the pack. After pushing through about three miles of fairly open pack we entered a long open pool in which we proceeded for thirty miles at full speed. We reached the end of this pool about 2330. There we pushed into 5/8 pack and as we went further it became much more consolidated. By midnight it was 7/8 pack and the Captain was not very happy. I persuaded him to continue and we pushed on through fair pack until 0800 on Monday 27. At that stage the pack was very heavy and our progress had become extremely slow, so the Captain suggested we should wait four or five hours to see if the ice would loosen up. We had not been able to obtain any radio contact with Wilkes station. Finally our radio operator Twigg was able to break in on a radio telephone conversation between Wilkes and U.S. ships. I asked for advice as to the best approach and whether there was any possibility of the icebreakers *Burton Island* or *Atka* giving us some assistance. I received a reply saying that a southerly wind up to 40 knots had compressed the pack in such a way as to prevent our passage. Unfortunately the *Burton Island* had left for Mirny and the *Atka* had broken one propeller in the ice and was therefore unable to assist. It became apparent that the southerly winds had consolidated the pack after I had made my flight and that the situation had changed very considerably in the last twelve hours.

At 0800 hours on Tuesday January 28, the Captain again started the ship and pushed into the ice but was only able to proceed for a couple of miles before giving up. At 0520 we had a discussion about the situation and I decided that because of shortage of time we would have to abandon the Wilkes visit. There was a strip of pack 80 miles in extent between us and Wilkes and, although we could have pushed through it laboriously over a period of several days, it would have taken an equal time to come out again. Instead, I decided to send our aircraft to Wilkes Station to deliver mail and to pick up Jerry Donovan, the Australian Observer, whom we

wished to take with us to Mawson. Consequently, at 0550 we started back the way we had come towards the open pool 28 miles to the north. We arrived there and put the aircraft out for its flight. It took off at 1831 and returned safely with Jerry Donovan at 2212. The ship departed soon after for Mirny.

On Friday January 31, at 2300, after a very easy approach and very little ice, the ship anchored about two miles north of Haswell Island. Next morning, Saturday February 1, at 0800 the ship moved in close to the shore and began to break fast ice in a narrow track parallel with the Mirny coast. At 1000 hours the Captain ran the bows of the ship into the ice cliffs and tied up with ice anchors. The crew placed planks and ropes across the gap and we were able to step ashore without difficulty. We went ashore and were met by Mr. Tolstikov (officer in charge, 1958) and Mr. Treshnikov (officer in charge, 1957). With them were Gordon Cartwright (the U.S. Observer of 1957) and Morton Rubin (the U.S. Observer, 1958). The Russians suggested we stay to lunch so we proceeded immediately to their dining mess. There we sat down to various courses of cold cuts and vodka. The leaders of each party made a short speech, and later the men sang songs. It was a very happy occasion. After lunch we were taken on an inspection of the station and I invited the Russians back on to the *Thala Dan* for dinner. The dinner was followed by Australian and Russian songs from the men and the party broke up about midnight. Next morning, Sunday February 2, the two U.S. Observers came aboard for breakfast and then escorted us ashore where I photographed various aspects of the station and completed my inspection of it. Shortly after noon lunch was held on the ship and at 1400 hours we sailed from Mirny for Davis.

I was anxious to proceed directly westwards if possible to attempt to plot the northern limit of the West Ice Shelf. We headed for the north-eastern corner of this feature and began to chart it but, at 0225 on Monday February 3, we were forced out from the ice front because of icebergs and fast ice. However, a little further north we were able to follow the consolidated ice and, although too far away from the West Ice Shelf to be able to plot it even by radar, we were able to run valuable series of soundings until we turned the corner and headed south into Prydz Bay. Our run down the bay was fairly easy, through open water with occasional pack, but there was plenty of heavy pack to the west of us. As we approached the Vestfold Hills we ran into great accumulations of small glacier bergs—even more than usual—and between these was much brash ice. The weather was fine and the scenery glorious. After a very cautious approach through 4/8 brash and icebergs right to our anchorage we anchored at 2111 hours. The aeroplane was immediately hoisted out to clear the deck for the DUKWS and the first one was unloaded at 2145. A party of us then went ashore, returning at 2300.

I found the station meticulously kept, spotlessly clean, and immaculately tidy. Its perfect condition was a great credit to Bob Dingle and his four companions. They had had a very good year in every way and had done far more than was expected of them. During the last few weeks they had even hacked out a DUKW track through a snowdrift near the beach, with labour involving 70 hours digging. They had also built a road through the boulders on the hill to complete a circuit for the DUKWS unloading at the rear of the station. All the huts had been freshly painted. For the next few days the programme was to be 0530 rise, breakfast 0600, work ashore commencing at 0630, lunch at 1300 and work to continue through until dinner at 2000. This schedule gave two long work sessions, one in the morning and one in the afternoon, without a break, and worked very successfully. The first day's unloading at Davis on Wednesday, February 5, went very smoothly and the

cased cargo was quickly despatched. By 2000 all unloading except aviation spirit had been completed. During the day I carried out soundings in the launch *Macpherson Robertson*, covering the ship's anchorage and the bay to the north. On Thursday work began with the backloading of cases and drums until almost lunch-time, after which the men proceeded with putting ashore the 105 drums of aviation spirit which were to be left at Davis. By 1500 this was finished, making the end of the cargo programme. At 0915 the aircraft was put up to carry out a photographic mosaic over the Vestfold Hills. This was successfully accomplished and the plane landed at 1415, just in time to dodge the brash and pack ice which soon covered most of the coastal water right up to the beach.

In the afternoon the 1958 party went ashore and the 1957 party moved on board. At 2130 we started a celebration to mark the change-over. This finished at mid-night, and the shore party went off, after hearty farewells, to begin their year's work. Earlier in the day I had decided to do a coastal reconnaissance of the deeper fjords; consequently at 1130 Donovan, White, Blair and I set off in the launch *Macpherson Robertson* in perfect weather, cautiously threading our way through the shallows close to the coast. About two miles south of Davis we had a particularly ticklish passage past a point of land upon which pack ice had encroached so as to leave only a narrow gap about 6 feet deep. We scraped through, although I was worried as to whether the gap would remain open for our return journey. Proceeding, we passed two beaches, one with thirty elephant seals and the other with fifty-six, and came finally to the mouth of Ellis Fjord. A westerly breeze had sprung up and this, together with the high tide, had packed sea ice and icebergs across the islands lying at the mouth of the fjord, thus preventing us from passing around between Ellis Fjord and Crooked Fjord. I therefore gave up any attempt to reach Crooked Fjord and decided to enter Ellis Fjord. The approach to Ellis is most deceptive. The valley winds about and small bays go back behind headlands, so that it is hard to know, at sea level, where the main passage is. We managed to choose the correct turnings and pushed inland through this winding maze until we came to what we call the "Narrows." This is a place where an outcrop of rock from the south, probably a moraine hill, practically blocks off the fjord and through the narrow passage that is left runs a rapid tide race. When we arrived there the situation looked bad; the gap was narrow with rocks each side and in the middle, and a tide race of 4 knots was rushing through in a flurry of eddies. As we reached the gap I put the engine in neutral, the tide rip took control, and we were rushed through (fortunately without touching) with very little water beneath our keel. Only about one mile further on we were blocked from proceeding any further by young ice $1\frac{1}{2}$ inches thick, leading on to fast ice much thicker which apparently blocked the rest of the fjord. I found that the launch was capable of breaking slowly through the $1\frac{1}{2}$-inch young ice; however, the sides of the launch were not well enough protected to stand the abrasive action of the ice. I had been taking soundings where possible but had been having a certain amount of trouble with the echo sounder. About 1430 we turned about and made our way back. We had a battle getting through the "Narrows" against the tide and luckily were going very slowly, for we scraped rock twice on the bottom. We reached the mouth of the fjord and found ice conditions even worse, so had no alternative but to head for home. However, when we reached the point where we had squeezed through the ice, we found a solid wall of heavy floes and rafted ice across the bay jammed against the point we had rounded. Our radio was working well and I advised the ship that we were blocked but that in the bay we were safe. I said we might have to stay all night but when the

wind changed we would get out. We spent some hours trying different approaches to the ice, and in between times lying anchored to floes from which we had to move periodically because other floes would drift down on us. The sight was glorious and we all took numerous photographs of the high floes at the side of the boat with their icicled edges and jumbled rafted tops, through whose fringes the sun shone like blue flame. It was an unforgettable afternoon. At 1900 I saw the wind had swung to the south so we made another attempt at the gap. I had an hour's fun manoeuvring the boat back and forth through narrow gaps in the floes until we reached reasonably clear channels leading to the ship. At one gap between two floes there was an ice foot extending from one floe beneath the gap. The launch slid up on to this and broke it with its weight. Two great chunks of hard, thick, blue ice splurged up as we passed by. We reached the ship at 2000 hours. Next morning, Friday February 7, the aircraft was swung outboard while the DUKWS were hoisted in, then the aircraft was returned to the deck. The ship weighed anchor at 0645 and proceeded out through the ice and shallows to the open sea without any difficulty. We noticed that our anchorage at Davis was being rapidly filled with floes. On February 8, Davis radioed to say that, ever since we had left, the whole bay had been choked with pack ice right to the beach, and that landings by any means under those circumstances would have been impossible. We were therefore lucky to have concluded our work in this area. This was an unusual occurrence which had not previously been seen in the bay.

As I was now a couple of days ahead of schedule I decided to attempt a landing at the Larsemann Hills, about sixty miles south of Vestfold Hills, which no ship had previously succeeded in approaching. We ran down Prydz Bay, first through open pack, then in open water in perfect weather. By noon we were closing in on Larsemann Hills. Adams organized a shore landing party for 12 men in two DUKWS and the launch, with provisions for four days and camping gear. I had intended to fly the plane from Larsemann Hills over the Lambert Glacier, but as there was some possibility that we might arrive too late to put it up, I decided to stop the ship, set the plane up at that spot and let it land after its flight at whatever anchorage we chose later on. We therefore stopped the ship at 1410, the plane took off and we proceeded on our way again.

The Larsemann Hills, fortunately, were reasonably ice-free and the ship was able to sail right in to the approaches to the main central fjord. She did not anchor, but simply dropped the DUKWS and launch at 1605 and sailed some miles back again. I took the vehicle convoy down the fjord but all the southern side was filled in with fast ice and unapproachable, or else the rock sides of the islands were too steep to land upon. A southerly wind sprang up and rammed drifting ice floes into the bays on our port side where we wished to land. I did not like leaving men ashore in case we could not pick them up again. However, we found a reasonably sheltered cove of ice-free water near one island and landed the men with their instruments and camping gear on an ice edge at high tide level. The DUKWS could not get ashore so I sent them back to the ship. Donovan, White, Blair and I then set off again in the launch to see what else we could find. There was a large, high island on the southern side of the fjord and we found a rock ledge beneath high rock cliffs upon which Donovan landed me from the dinghy. I made a rock climb to the top of the 60-foot cliff and continued an easy scramble from there to the summit of the island, from which I took a round of photographs. I was soon back and we returned to the ship for dinner at about 2000. In the meantime, the aircraft had returned from a successful flight. After dinner I returned to the island in the launch to pick up the

men, for I was not happy about the ice situation. I found the small bay filling rapidly with slabs of old fast ice about 6 inches to 12 inches thick. The men were waiting anxiously on the ice ledge with all their gear. By pushing some floes aside and cracking others we were able to reach fairly close to the shore. We sent the dinghy in the rest of the way and ferried the men with a number of trips through narrow cracks, while I had some difficulty in turning the launch ready to get out again. We finished this manoeuvre safely and returned on board at 2145 hours.

As the weather was good and there appeared to be open water to the south, I decided to attempt a landing on the Bolingen Islands, so the ship proceeded at 2200 hours. We first sailed fairly wide to the west in open water, then turned south. After a few miles we met hundreds of jumbled icebergs of fantastic sizes and shapes and the sea was covered with frazil ice and young ice. In the dim light between 2300 and 2400 hours White, Donovan and I stood on the bridge, tired but unable to leave the scene, and fascinated by this strange graveyard of giant icebergs. I recalled sledging amongst them on the way to Lichen Island in 1955 and being impressed by their awesome majesty. We reached within about three miles of the main Bolingen group but were blocked off by fast ice. As there was open water leading eastwards, again covered with frazil ice and pancake ice, we decided to follow it back to the most southerly part of the Larsemann Hills. At about midnight we were making an approach to the only bit of rocky mainland that appeared accessible and free from fast ice, when we had to pass between two grounded bergy bits, each quite large. When the depth reached 20 fathoms the Captain backed out and anchored off an outlying island at 0050 on Saturday February 8. The launch was immediately put out and at 0115 Donovan, White, Blair and I set off on a reconnaissance.

It was eerie in the twilight and the moonlight, with a dull reddish tinge on the sunset-sunrise horizon to the south. I steered the launch past two small islets, as I wanted to reach the mainland if possible, and we pushed on past towering icebergs through narrow chasms of blue space over waters whose surface glistened with the oil-slick appearance of frazil ice. I kept a mental note of the appearance, looking backwards, of each iceberg so that I would be able to find my way through these channels back to the ship. The sea was now freezing fast. It already showed an inch of sludge and we were forced to avoid floes of young ice more than 6 inches thick and as hard as rock. About half a mile further on we reached another long islet with two smaller ones to the left, one of which rose as a very high 200-foot knob. Over the rocks of the smaller one I was surprised to see spray flying and noticed that quite a ground swell was swirling and dashing on its southern side. We edged cautiously through the ice between the islands and I began to feel very confident now of the splendid launch in which we were sailing. This corner between the large and the two small islets looked a bit nasty as a trap for ice on the return journey. However, we pushed through and saw, about a mile further on, the shores of the mainland. I was disappointed to find, as we approached through heavy sludge, that the whole coast was fringed with fast ice. We approached and anchored to the fast ice edge, leaving Blair to look after the boat. White, Donovan and I clambered out onto the slippery fast ice and walked across to the shore, noting a number of cracks up to 6 inches wide on the way. This did not surprise me, in view of the swell noted earlier, and I considered that it would not be wise to stay there too long. I was not quite prepared, however, for the speed at which things really happened. At the shore the ice had already broken up quite a bit and was heaving and cracking in the ground swell, with water hissing and gurgling as the

Davis Station, Princess Elizabeth Land, Australian Antarctic Territ

Photograph: ANARE, W. R. J. D

floes closed and opened. I dashed ahead to climb a rock for photographs, although the light was very bad, and called to White and Donovan, "You had better hurry and put your foot on the shore so that you can say you have landed, but be quick and hurry back to the boat immediately. I shall catch up with you." I took five minutes to get my photographs from the high rock, then ran down to the heaving ice and jumped a few cracks to catch up with the others. Together we went on, finding that the whole lot was rapidly breaking up and drifting out. We were forced to take a most roundabout course, detouring to find places where the cracks were narrow enough to jump, or waiting until the floes drifted together if the gaps were too wide, but after half a mile of this we reached the launch safely and found that instead of lying against a straight ice edge it was now in a narrow channel between ice floes. We had to break one floe and use full power to push others aside before we got out, and suffered a groove in our hull on the starboard side.

We retraced our path and found the gap near the islands becoming extremely difficult, as I had foreseen, so much so that I decided I would not take my scientific party further than the large island which formed one side of this gap. Back we went through sludge which was now twice as thick as on our way out. (The temperature was 19° F and the water was freezing fast in the calm conditions.) We reached the ship at 0310 and I collected the geophysicists, surveyor and geologist, leaving Donovan and White on the ship. We left again in the launch at 0330 to go back and land on the large island. When we reached the accumulated icebergs we found the ice floes had blocked all except a 12-foot gap hard against one berg. We hesitated for a second or two, wondering if we went through whether we could later get back, and wondering also whether the sound of the engines would bring the pinnacle of the berg crashing down on the boat. Then we rushed through the gap at full speed to find that the sea between there and the islet—half a mile of it—had frozen further to the pancake stage. The launch engine was working hard to push the boat through, while there was a constant swishing, scraping, crackling sound as the woodwork parted the solidified ice. We left behind a wake of fragments like broken panes of plate glass (see plate 2).

The state of this sea ice was really disturbing. If the men were to stay ashore for nine hours as I had planned, the sea could freeze up to 4 inches thick and we would not be able to move it with the launch. Should we risk it? Of course, if any wind arose it would break up the ice, so I thought it worth the chance. We reached the chosen islet and anchored against an ice ridge attached to the shore above tide level. The men unloaded their instruments and survival gear and I took the launch back to look at the gap again. The ice on the way back was even worse, but when I reached the icebergs I found, after a short reconnaissance, that by detouring for about a mile to one side we could use a better gap, where the water was more open and there were no floes jammed between the bergs. Having found this more open roundabout route back to the ship I felt happier, so returned to the island where I found the men busy at work on gravity, astrofix, geology and magnetic investigations. The islet was fixed as being 69° 23′ S., 76° 03′ E. Shortly afterwards a fairly stiff easterly breeze arose and with a temperature of 24° F it was cold work for the men on the crest of the hill where the surveyor had to set up his theodolite. From the summit of the island I looked across the stretch of water to the north-east and saw the cliff-faced islet that I had scaled the day before. I then realized that, for all our night's work, we had come around in a large circle to within three miles of our previous landing. I spent an hour photographing general activities then picked up Jesson, the geophysicist, and McLeod, the geologist, who had finished their work.

he iceberg gap negotiated by the launch (*see p. 337*)
otograph: ANARE, P. G. Law

Then with Blair we set out for the mainland at 1030. We found that the easterly wind had blown all the detached fast ice and the newly formed ice across the water and piled them up against the iceberg gap. A lot of the icebergs had also drifted into new positions so that their configuration bore no resemblance to what it had been earlier. However, with the wind clearing the ice from the water, and the top of the ship's masts visible in the distance beyond the islands, I no longer worried about returning. We sailed into the large fjord (the major fjord of the system) leaving the islet I had scaled the previous day to port, and when we reached the outer edge of the main Larsemann Peninsula, from which all the fast ice had now cleared, we were able to land on a ledge of ice above tide level. A few hundred yards inland rose a large bluff with interesting geological strata, and as far as I could see the place where we had landed early that morning was a mile or mile and a half to the south. Leaving Blair in the launch we walked to the bluff, beneath which was a lake with interesting green algae growing on the bottom, giving the lake from above that emerald-green hue often noted in lakes at Bunger Hills and Vestfold Hills. We climbed the bluff and saw beyond it a high peak about 550 feet above sea level, which we also climbed. From here we had a magnificent view of the whole of the Larsemann Hills. I took a series of photographs and made a rough sketch. At 1245 we left the mainland by launch, returned and picked up the men at the islet, and made an easy wide sweep through magnificent icebergs back to the ship, arriving at 1400.

I had arranged for another aircraft flight while we were away in the launch, with Wilson as pilot and Downer as observer. The plane took off at 0959 to carry out a photographing flight up to the Vestfold Hills. However, the plane had just climbed to height near the ship and set off on its run when the propeller speeded up abnormally. Apparently something was wrong with the hydraulic pitch adjustment. In any case the pilot was forced to land at 1116. Luckily he was close to the ship. With the plane out of action and our landing having succeeded, I decided to cease work in this area and at 1500 on Saturday February 8 we sailed for Mawson. Echo-soundings were again started, and continued until we reached the Mawson area. During this part of the voyage, finding that we were well ahead of schedule, I decided to push on to Enderby Land prior to unloading at Mawson. It was obvious that, once the ship was empty after unloading, there would be no possibility of any further exploration work, so it was a case of proceeding immediately or not at all. However, the Captain wished to get rid of the deck cargo and I wanted to put ashore the scientists so that they could carry out "familiarization training" in our absence. We arrived at Mawson, just outside Horseshoe Harbour, at 0930 on Monday February 10 to find a strong 30-knot katabatic wind blowing. As the Captain was not prepared to bring the ship into the harbour in this wind and as I did not want to waste time, it was decided that the ship would drift around outside the harbour (it was too deep to anchor) and there unload the men, the aeroplane and the DUKWS. After that we could leave for Enderby Land. At about 1130 we put the *Mac-Robertson* launch over and I went ashore with the men. Ashore I met Hannan, the second in command, who was in charge of the station in Mather's absence, and he showed me around the station. Immediately afterwards the pontoon was lowered, given a load of deck cargo drums, and towed to the shore. In view of the arrangements I had made I was rather surprised a short time after to see the ship sail into the harbour and anchor. From its anchored position we unloaded two more pontoons of drums, but at that stage the wind rose again, the ship slewed around, dragged her anchor and finished up leaning against the rocks of the western

arm of the harbour. The Captain had no difficulty in manoeuvring the ship off the rocks and sailed out of the harbour immediately to resume drifting in the bay outside. While there he unloaded the two DUKWS and the aircraft and we sent out Beaver 201 from the shore to be hoisted on board. (I wished to carry out photographing flights of Enderby Land and, as Beaver 203 was out of order, we took Beaver 201 in its place.)

We had a final load of petrol and aviation gas drums to take ashore before sailing. Unfortunately the man steering the launch, when towing the pontoon away from the ship's side, turned too sharply and capsized the pontoon. Adams and Bolza on the pontoon had narrow escapes. Adams managed to claw his way over the pontoon as it rolled, so as to finish on the upturned bottom without getting wet, but Bolza went right under with the pontoon and drums on top of him. He succeeded in getting out from under and Adams dragged him up on to the capsized pontoon. I organized both DUKWS and the launch into saving the drums, passing down to the men a number of short lengths of rope for attaching to them and dragging them back to the ship. The wind was strong, the drums were heavy and the job was difficult; however, we could not afford to lose the aviation spirit. Twenty-four drums were floating away, but after $1\frac{1}{2}$ hours' hard work all except three were captured. By the time we had hoisted the launch and the pontoon on board it was dinner time, and at 1850 we sailed for Enderby Land. The wind arose and Thompson, with a couple of men, worked hard on the deck securing things. Before midnight the wind had risen to 50 knots and the Captain hove to. All day Tuesday, February 11, we remained in the same spot, the Captain being reluctant to proceed north through the icebergs. Between 1800 and 2100 he began to edge his way northwards and after that he proceeded steadily until 0130 when he heaved to again until 0600. We then resumed our voyage.

Later on Wednesday we passed Japanese whaling ships and later still a Russian factory ship and its chasers. We started soundings about 2100 and I stayed up most of the night to watch our progress. We had a good view during the day of Proclamation Island and the Cape Ann area with Mount Biscoe and the inland mountains. During the day we affixed strips of wood to the belly of the *Mac-Robertson* launch to prevent further abrasive action by ice. The R.A.A.F. fuelled the plane and Adams prepared landing equipment. At 1600 we met an ice edge which appeared to extend indefinitely NNW. and SSE. We were now just 20 or 30 miles to the west of Amundsen Bay. To the east we could see many icebergs. Unfortunately, at this time it began to snow, the visibility was bad and we were unable to put up the aircraft. At 1930 I asked the Captain to move in eastwards towards the coast. The snow showers had cleared, the wind was still 16 knots but had not freshened, and the barometer was dropping only slowly. We could see the Tula Range and the coast. At 2030 we ran into loose pack a few miles off the coast and were forced to stop. From here we could see into Amundsen Bay and decided to wait overnight.

On Friday, February 14, I arose at 0320 to find cloudy weather with a north-east wind, a north-west swell, and a dropping barometer. However, I decided to try and hurry through a couple of aircraft flights. The plane was hoisted outboard at 0600 and we found it a ticklish business in the heavy swell. Evans and Johnston took off at 0622 on a test flight of Beaver 201 and on an ice reconnaissance of Amundsen Bay. They landed at 0742. The wind and swell were bad and we had trouble getting the plane alongside, so we decided to give up the second flight and to hoist it on board immediately. This we did with some risk and trouble. The airmen told me they had found some new islets not marked on the chart, close to the continental shore

just north of the entrance to Amundsen Bay. They had noted also that a narrow lead of water ran along the continental ice cliffs from this point into the Bay. The Captain did not like the idea of sailing along this channel but agreed to take me to the islets near the entrance. We arrived and anchored off the islets at 1100 and at 1115 I took the launch with a group of men to land on them. There was a fairly rough sea, whipped up by a 30-knot north-east wind, and we sailed around three islets without finding any place suitable for a landing. There was a heavy surge on the rock and the ice ledges above the high tide mark were all too high or too fringed with rock for us to approach in the launch. It was frustrating at this stage to be unable to land, having found such suitable islets, and when I found finally an ice ledge about 6 feet above water level, under which water appeared to be deep enough for the launch, I took the boat in. The next ten minutes were rather hectic. The launch heaved up and down in a 4-foot surge and bashed against the ice. Sometimes it would sink in a trough and slide its stem in under the ice ledge, then rise and grind into the ice, breaking off great chunks which fell on the deck. I stayed at the wheel alternately backing and charging to maintain the launch's position while the young scientists outside scrambled ashore with their instruments. As soon as possible we pulled off again, leaving only Knuckey and Stinear ashore. It was decided not to risk the gravity meter or the magnetic instruments as they might become damaged in this form of landing.

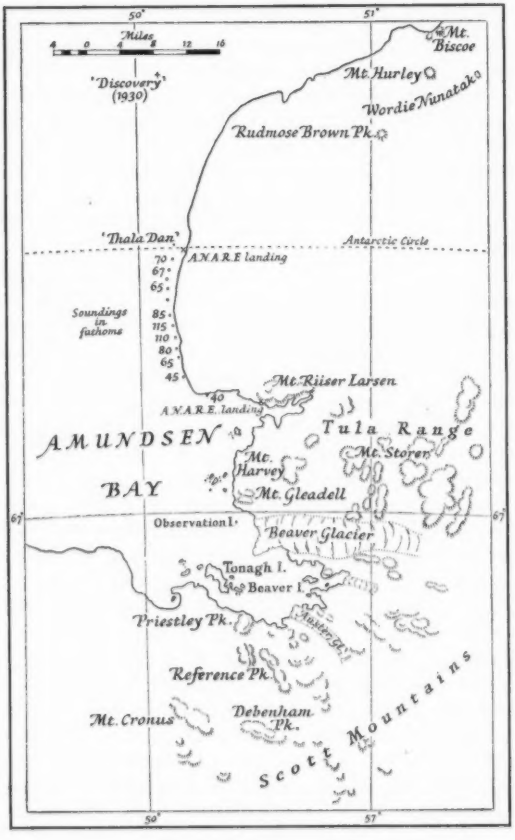


Figure 2

Knuckey was established on the crest of the islet by 1230 and obtained a good fix. He and Stinear built a cairn and deposited under it a cyclinder I had given them containing a small Australian flag and a note describing our landing. Later, at 1600, Thompson collected Stinear and Knuckey in the ship's small motorboat.

In the meantime, I had decided to proceed into Amundsen Bay in the launch.

I collected Donovan, White, Lucas and Adams as a crew and we set out at 1245. The weather looked a bit brighter, but there was still a strong north-east wind and a lot of cloud. I used the echo-sounder to obtain records of the depth as we ran along the coast about three-quarters of a mile off the ice cliffs of the continent, past the group of islets and past several skerries further on. As we proceeded conditions improved. Ahead could be seen the point where the R.A.A.F. had said the open channel was almost closed by icebergs converging on the ice cliff. We negotiated the first iceberg gap which was several hundred yards wide without difficulty. The second was half blocked by floes and brash and needed more manoeuvring. As we passed through the second gap where the ice cliffs turned to run in to Mount Riiser Larsen I noted that the north-east wind was holding the ice away. It was obvious that should the wind swing south the gap would close up. From there until our return I was somewhat worried by this possibility.

Around the corner the view was glorious. Some half mile ahead we could see the open pack give way to clear water. When we reached this we found ourselves in a great expanse of blue bay, smooth as a lake, fringed by mountains of alpine grandeur, on which the sun shone brightly. The scene was the best alpine one I have seen in Antarctica and we all took numerous photographs. We decided to sail up to the large peak, which was the most westerly of those along the northern coast of the bay, although it seemed at least five miles away. I now believe this mountain to be the one named Mount Riiser Larsen by Sir Douglas Mawson in January 1930 when he saw its peak from some distance out at sea. We were exhilarated by the scenery. It was as though we had sailed our launch around a corner and suddenly emerged onto a Swiss lake. The weather was now perfect, with a light north-east wind and warm sunshine. However, a front of white heavy cloud backed by dark ominous sky could be seen moving up from the west. Until now we had held radio schedules every hour but once around the corner of the continent our signals could not get through to the ship and the ship's signals, although audible, were unreadable. We landed on a low ice ledge near the foot of Mount Riiser Larsen at 1715, $4\frac{1}{2}$ hours after leaving the ship. I estimated we had come about 25 miles. As time was pressing we agreed to try to return to the boat by 1745. Hurriedly collecting our cameras, we walked quickly across a narrow moraine valley and climbed a small headland about 100 feet high just east of our anchorage. The moraine erratics were lacking in variety and seemed to comprise only the ordinary gneissic country rock, very different from the varied assortment to be found at Mawson and Davis. At the top of the ridge we stayed for about ten minutes. We built a small cairn and took photographs. The view was splendid. Unfortunately the sun disappeared behind the clouds just after we reached the top. Reluctantly we hurried away from this spot. All of us would have loved to have spent a fortnight in this region. As we walked back towards the launch a light southerly breeze fanned our faces and rippled the water below. This caused us to hasten even more as we thought of the iceberg and pack ice gap we had to negotiate.

We left at 1800 and as we sailed away we could see the heavy bank of cloud almost overhead. When we reached the gap the wind was still north-east and the ice had not changed much, although it was somewhat closer and we had more trouble penetrating it than on the way in. From there all was straight going. We regained radio touch with the ship and continued our depth soundings on the way back. The water along the ice cliffs was wide and reasonably smooth, with an average depth of 70 fathoms. I was very sorry that the ship had not come in there, for from this place it would have been easy to send up the aircraft. As it turned out, the wind all

day at the ship had been too strong to permit the aircraft to be launched. Thus we lost a magnificent opportunity of photographing the Amundsen Bay area in sunshine.

We reached the ship at 2200 in darkness, the last few miles being very rough indeed with a strong 40-knot north-east gale. We were guided back by flood lights on the ship. It was a risky business hoisting the boat and we were afraid it would be damaged but the manoeuvre was successfully accomplished and the ship sailed at 2210. We were very satisfied with our landing and quite content to proceed now to Mawson to complete the relief of the station.

The new ship *Thala Dan* proved to be efficient and luxurious and a considerable improvement on the *Kista Dan*. The Captain, officers and crew were pleasant and cooperative and the success of the voyage owes much to their efforts. I wish to record my appreciation of the excellent work of Richard Thompson, my lieutenant for the voyage, who has now made a large number of voyages with me in this capacity; also of the valuable work of Osmar White, the journalist who accompanied the expedition, who worked so hard to present the story of the voyage to the Australian press. I was glad to have the opportunity to pick up Jerry Donovan at Wilkes Station, for the voyage afforded an excellent opportunity for us to discuss his visit to the United States bases and he contributed much to the work of relieving the Davis and Mawson stations. Finally, no report would be complete which did not record the invaluable assistance rendered by the Army team led by Lieutenant David Solomon and its two DUKWS and the enthusiastic and indefatigable work of the 1957 and 1958 Mawson and Davis parties.

Summary.—The 1958 voyage of the *Thala Dan* was the longest, most comprehensive journey that the ANARE has yet accomplished in Antarctic waters. The ship traversed almost the whole coastline of Australian Antarctic Territory and Terre Adélie, and a number of landings was made on parts of the coast previously unvisited by any ship. Although bad weather and heavy ice prevented the ship from reaching the coast of Oates Land at the eastern extremity of the Australian sector, favourable circumstances made new landings possible at Larsemann Hills, in Prydz Bay (Princess Elizabeth Land), and at Amundsen Bay (Enderby Land). Valuable series of echo soundings were obtained and the stations at Davis and Mawson were relieved without incident. An automatic weather station was established at Lewis Island, Wilkes Land. Visits were made to the French stations at Dumont d'Urville and Îles de Kerguelen and to the USSR station at Mirny. The ship also called at Heard Island during the return voyage to Melbourne.

GEOPHYSICAL INVESTIGATIONS OF THE COMMONWEALTH TRANS-ANTARCTIC EXPEDITION

I. THE CLIMATE AND ICE MASS BALANCE

H. LISTER

On the Filchner Ice Shelf at the Shackleton Base of the Trans-Antarctic Expedition and on the inland plateau at the "Southice" station (4400 feet) the snow surface was marked by strings[1] and pegs every 2–3 weeks during the year 1957. Pits dug along the line of the markers revealed vertical profiles of the snow layers similar to the stratification as shown in shelf ice cliffs (Plate 1). Fine-grained snow, well compacted and containing many wind crusts, was the dominant characteristic of winter accumulation. Some of the snow accumulated during the summer was similar, but usually contained one or more layers which were coarser grained and less compacted.

Between many of the early and some of the late summer markers there was a fairly open layer of larger grains sometimes oriented vertically. These loose, cup-shaped grains, called *Schwimmschnee*,[2] or depth hoar,[3] which generally occurred beneath a wind crust, are probably produced by metamorphism of spring or late summer snow which is immediately below the surface when the air temperature is changing most rapidly. The large temperature difference across the surface layers at these times produces a steep gradient of vapour pressure which causes vapour transfer and the vertical development of the crystals. Stephenson[4] found that wind crusts comprised very small crystals, tightly packed, but with similar vertical orientation. Again it appears that the vapour transfer, in this case caused by the strong wind over the surface, produces the vertical growth.

The criterion layer of depth hoar was not always present in a year's accumulation and in some cases was repeated above and below a hard summer layer which could, without the markers, have been interpreted as winter snow. By plotting the vertically measured density, grain-size and texture, a cyclical arrangement of strata could be seen from which mean annual layers have been interpreted with an approximate error of ± 50 per cent.

For vertical profiles of temperature measurement and for the seismic shot, a bore-hole was required. The drilled cores were examined for grain-size and texture and 10-centimetre lengths were weighed on a spring balance for density measurement (Plate 2).

Recovery of snow cores for the first 1 to 2 metres depth was rarely complete, due to collapse of the more friable layers, so the core drilling was supplemented by Rammsonde sounding (Plate 3), which was much quicker than either the pit or snow core method and was invaluable in detecting stratification.

At "Southice" the logarithm of Rammsonde values of resistance to penetration when correlated with measured values of density gave a highly significant coefficient of 0·879 and a regression line $\rho - 0{\cdot}207 = 0{\cdot}103 \log_{10} R$, where ρ=density and R=Rammsonde value. The standard error of estimating density is 0·024, so the product of layer thickness and mean interpreted density from the above equation was used in assessing the water equivalent of the mean annual accumulation.

Errors due to bounce, which occurred when penetrating well compacted layers (>0·5 g./c.c.), and due to friction along the wall of the penetrating tube, corroborated experience in Greenland[5] in becoming appreciable at some sites with depths greater than 2 to 3 metres.

Below 2 metres depth, Rammsonde values were used only as an aid in differentiating seasonal strata, the weighing of cores supplying accompanying values of density.

At "Southice" Stephenson and Blaiklock each dug a pit and measured density and texture profiles which, with similar profiles from bore holes, gave a fairly reliable interpretation of annual accumulation since 1895. These investigations were not carried to a uniform depth; so, to avoid error (*e.g.* in comparing the mean

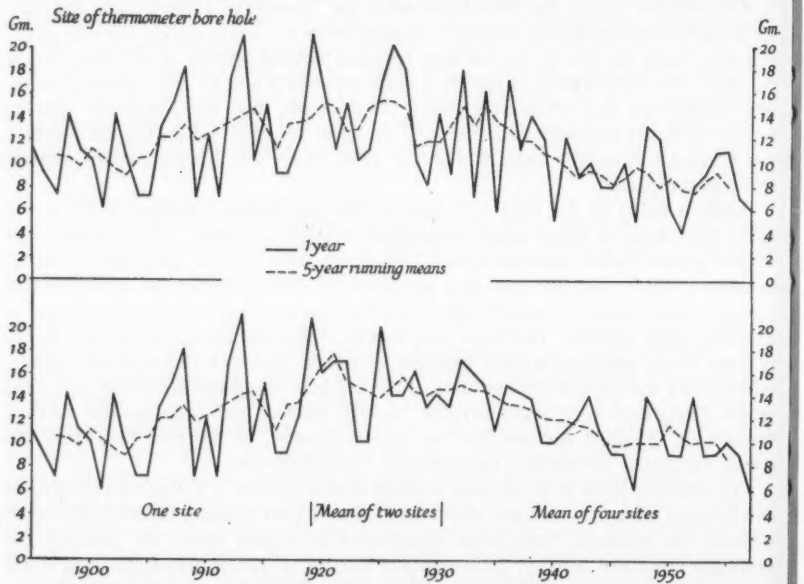


Fig. 1. Snow accumulation at "Southice" interpreted from pits and boreholes

of four sites with the mean of two sites) two graphs are shown in Figure 1. It will be seen how the mean annual accumulation was approximately 10 gm/cm.^{2} at the turn of the century but increased slightly during the 1920's, decreased in the 1930's, and is rather less than 10 gm. at the present time. It is interesting to note that the profile from "Northice" (North Greenland)[1] also showed a lower accumulation about 1900 with an increase in the 1920's and a decrease in the 1930's, but the two stations show slightly different trends in the 1940's.

Data for accumulation measurements were recorded at nightly halts across the continent and were accompanied by observations on sastrugi direction, mean height and spacing.

During much of the year at " Southice" it was observed that snowfalls were frequently accompanied, or soon succeeded, by moderate winds. The surface snow was blown into characteristic "laundry iron" patterns and travelled down-wind very

Photograph: Trans-Antarctic Expedition

1. Snow stratification revealed in ice-shelf cliffs

Photograph: Trans-Antarctic Expedition

2. Examining drilled snow cores for texture and grain-size

Photograph: Trans-Antarctic Expedition

3. Sounding surface snow layers with the Rammsonde

Photograph: Trans-Antarctic Expedition

4. Very hard sastrugi showing two wind directions

like sand dunes. The stronger the wind, the more acute was the angle at the head of the sastrugi which pointed up wind. A slight change in wind direction (particularly after a few days of light or moderate wind, during which time a slightly harder crust formed) had an erosive effect on the sides and front of the sastrugi, considerably sharpening their vertical profile (Plate 4). At "Southice," with two major and one minor wind direction, the sastrugi showed these directions proportionately. Some of the tallest sastrugi, with the hardest surface and hence more undercut (since these sastrugi persist in all winds), were aligned with the direction of strongest winds whereas the more closely set sastrugi were aligned with the dominant wind direction which was generally a wind of lower velocity. Thus the wind direction, and some measure of wind strength, is recorded in the sastrugi (Fig. 2). Over the continent, the wind direction is broadly anti-clockwise but some deviations, probably due to topography, become evident between the Pole and the Ross Sea.

Some outstandingly large sastrugi extending 20–30 metres, and in form like a sector of a dome, were called "whalebacks." In the next size-range of surface undulation were the troughs and basins 3–20 miles across and 60 to 300 feet deep. Figure 3 summarizes these different surface forms, the combination of which caused so much trouble to the vehicles.[6] The wave-like ridges that extended across our course had well spaced sastrugi and a hard surface on the crests. The sastrugi were very closely set on the slopes, especially on the steeper north-facing slopes, and were softer and often thinly buried in the troughs.

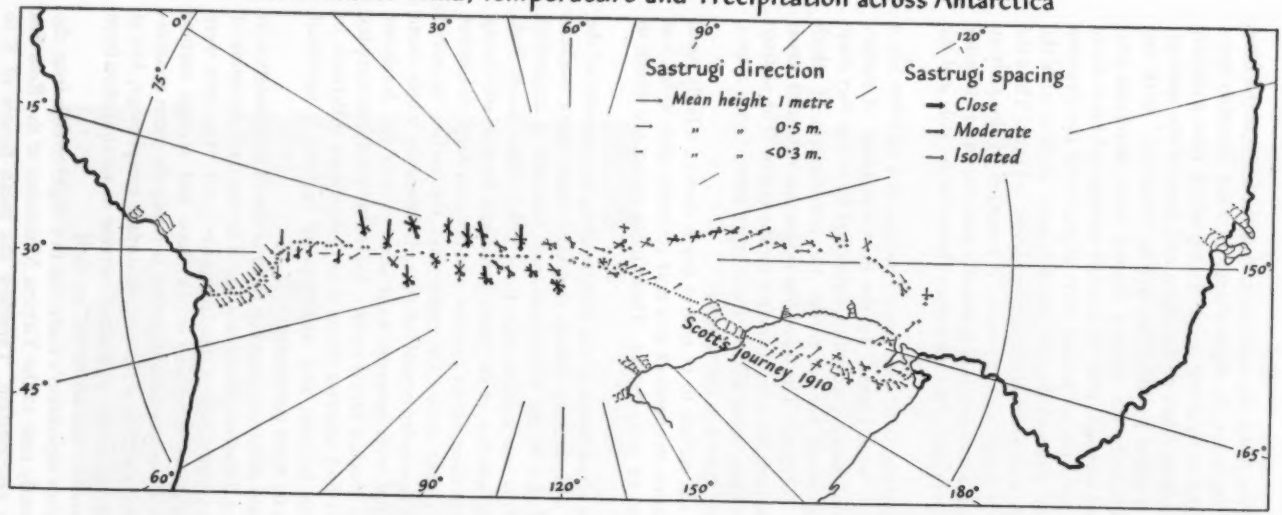
Temperature profiles from the surface to 11 metres depth showed a fairly rapid fall from the approximate summer temperature to a near constant value which was interpreted as the mean annual air temperature. These mean values are shown in Figure 2.

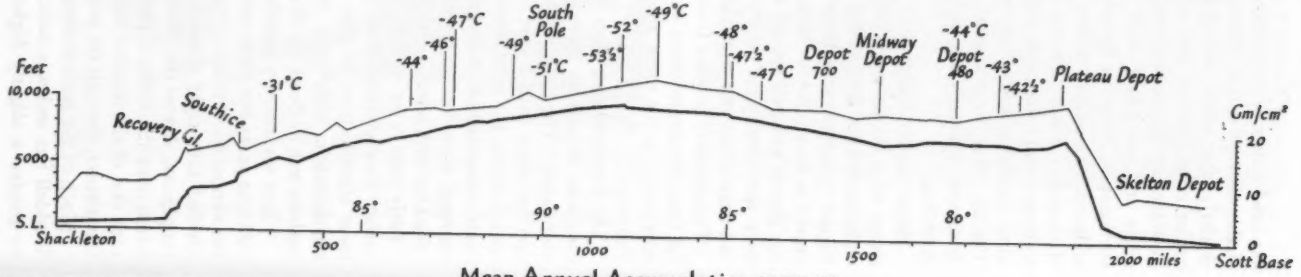
The interpretation from the snow layers of the climate along the transect of the continent reveals an annual accumulation which is greater than many workers postulated.[7] The transport of snow by the wind leaves some areas free of accumulation for more than a year. This was evident near the United States South Pole station where the faint intermittent line of ski tracks could still be seen after being made a year earlier. Adjacent to these harder patches, and between deeply undercut sastrugi, were low drifts of recent snow. On many days the surface appeared sprinkled with small, vertical, triangular crystals of rime; but over the whole route a fairly thin layer of soft snow, with frequent, hard sastrugi, was the dominant surface characteristic (Fig. 3). Such a varied surface inevitably produces complex snow stratification, so that to find whether there is any significant difference in accumulation with time, with latitude, and with type of surface, a statistical analysis was made of the data on snow accumulation.

There was no very significant difference between the amount of accumulation in different years but there was a difference between sites. The standard deviation of the annual accumulation was $3\frac{1}{2}$ gm., with a standard error $\pm 0{\cdot}2$. The sites were divided into eight groups (Fig. 3) according to the slope and average surface roughness. Across the plateau there was no significance between the mean accumulation over the zones delimited by their difference of surface morphology, but at each end of the traverse there was a very significant increase in accumulation from the plateau, through the mountains and across the ice shelf.

Much of the surface along our expedition's route was in a slight trough from the Weddell Sea and was sufficiently near to the Victoria Mountains of the Ross Sea to receive a slightly higher precipitation. Therefore the mean figures of 8 to

Mean Annual Wind, Temperature and Precipitation across Antarctica





Mean Annual Accumulation 1952-57

Surface Morphology across Antarctica

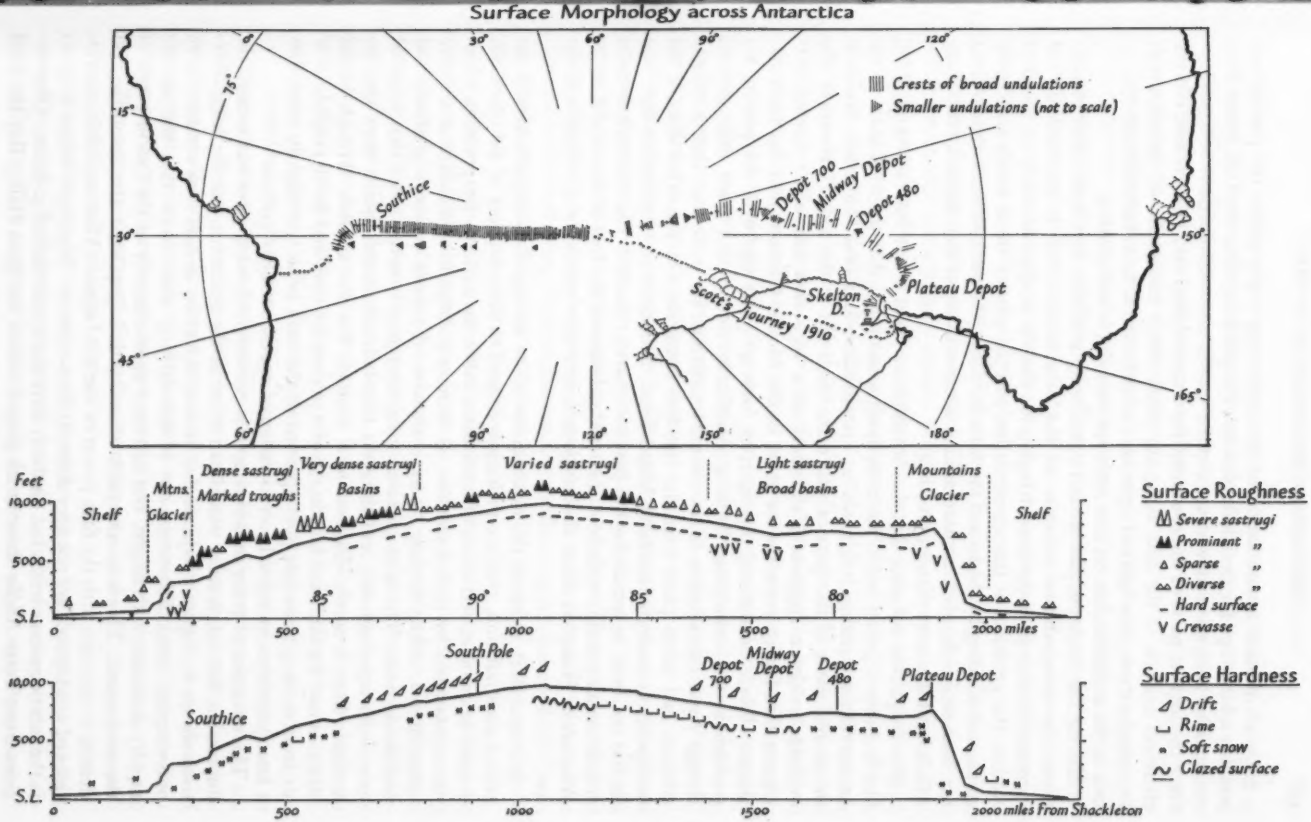

Surface Morphology across Antarctica
Crests of broad undulations
Smaller undulations (not to scale)
Southice
Depot 700
Midway Depot
Depot 480
Plateau Depot
Skelton D.
Scott's journey 1910
Feet
10,000
5000
S.L.
Shelf
Mtns.
Glacier
Dense sastrugi
Marked troughs
Very dense sastrugi
Basins
Varied sastrugi
Light sastrugi
Broad basins
Mountains
Glacier
Shelf
0
500
1000
1500
2000 miles
South Pole
Depot 700
Midway Depot
Depot 480
Plateau Depot
Southice
2000 miles from Shackleton
Surface Roughness
Severe sastrugi
Prominent "
Sparse "
Diverse "
Hard surface
Crevasse
Surface Hardness
Drift
Rime
Soft snow
Glazed surface

Figure 3

9 gm/cm.² of snow accumulation in the undulating zones across the plateau are possibly a little high for the whole plateau. The glaciologist[8] at the U.S. South Pole station, after analysis of snow strata, reports a mean accumulation there of 6 gm/cm.² Over the highest parts of the continent the accumulation may be even less, but the statistical analysis of the data along our route shows no significant variation with topography there, so a figure of 7 gm/cm.² would seem to be a reasonable interpretation of the available data on accumulation over the inland plateau.

Moving out from the plateau and considering available data from other expeditions, the accumulation increases as the mountainous rim is approached, and increases further over the coast-fringing ice shelves to approximately 25 gm/cm.² Adding the products of the accumulation and the area of these nearly concentric zones, and dividing by the area of the main ice dome (the peninsula of Graham Land has been omitted), gives a mean annual accumulation of the Antarctic ice sheet, which is a little more than 13 gm/cm.²

It is frequently assumed that the Antarctic ice sheet is in a state of equilibrium. but as Loewe[9] points out: "the underlying assumption that the total mass of the ice cap does not change is doubtful . . . it will take a long time before any change in the nourishment of the interior will make i tself felt at the coast." However, the available evidence suggests a stalemate or a very slow recession: Shoumsky[10] reports that for 55 years the ice sheet in the Mount Gauss region has been stationary. Péwé[11] compared photographs from 46 years ago with the present ice position in the mountains flanking McMurdo Sound and finds little change, though from examination of ice-covered moraines he postulates that a minute advance had taken place over the last few centuries. On the other side of the continent, in western Dronning Maud Land, Swithinbank[12] concludes that "the ice has not been in retreat for the past 100 years or more." The thin debris cover and the small moraine with frost-shattered debris near the foot of the ice cliff at the Whichaway Nunataks there also suggests a very slow retreat or a stalemate of the ice.

It is necessary to assess the mechanisms of ice wastage for comparison with the annual accumulation. Surface melting is limited to the periphery of the continent, is small in amount, and much of it refreezes below the surface. Evaporation, sometimes countered by rimè formation, is extremely difficult to measure at negative temperatures, either directly or by evaluation of vapour pressure gradients and turbulent winds. The heat required for evaporation is seven times that required to melt an equal amount, and since the heat-balance measurements show that the available heat is small, evaporation is limited. Yet the air flow through buried strata caused by the wind blowing over a porous medium and by the expulsion of air from settling snow (air flow up some of the bore holes was slightly more than 2 knots) could cause a loss by evaporation of approximately 1 gm/cm.²

The struggles of polar explorers against persistent blowing snow has created the impression that much snow was blown from off the continent, but the wind directions shown in Figure 2 indicate that an anti-clockwise motion is as common as an outsweeping wind. Measurements of the drifting snow show that the amount rapidly decreases with height, but increases approximately as the fourth power of the wind speed. This is in reasonable accord with Liljequist,[13] who found the drift density to increase with the fifth power of the wind speed. Most available observations of wind speeds are not very different from those at "Southice" where 20 knots is the most common wind, but on thirty days the wind reached 40 knots. Observations from Terre Adélie show much greater values but from Halley Bay the wind

speeds are less. Assuming these mean winds to blow seawards from the coast of the continent, the weight of drift removed is approximately equal to 0·02 gm/cm.^{2} Because of the dependence of drift upon the high power of the wind speed, a few additional snow (and/or drift) storms could increase this value; a generous estimate is 0·1 gm/cm.^{2} over the area of the continent.

The wastage mechanisms discussed above apply to the snow surface, which is being covered periodically by additional snow. The accumulation data were interpreted from snow stratification of recent years and hence are net accumulations, having already lost most of the snow which could be removed by the mechanisms discussed above. Evaporation, but at a very slow rate, could continue due to expulsion of saturated air by settling of the snow.

An obvious wastage mechanism is the production of icebergs that calve off the northward flowing glaciers and ice shelves. The rates and thickness of ice-flow from off the continent are extremely varied. Wright and Priestley[14] quote rates of flow from 12 to 300 metres per year for glaciers and 450 metres for the Ross Ice Shelf. Gould[15] gives 450 metres per year as the movement of the Ross Ice Shelf. An ice shelf in western Dronning Maud Land is estimated by Swithinbank[16] to move about 300 metres per year. Dolgouchine[17] gives glacier speeds of 300 to 1000 metres per year but shows much lower speeds for neighbouring ice not channelled. Shoumsky[18] gives speeds of 20–40 metres per year for ice between the fast moving "valley" glaciers and up to 130 metres per year for the ice edge and for slightly active areas inland. Measurements[19] of ice movement near Mawson give an approximate mean of 18 metres per year, but annual movement of the "typical" Taylor Glacier is approximately 120 metres.

To summarize these observations: the channelled ice of glaciers and shelves moves more rapidly than the general ice sheet. Speeds range from 12 to 1000 metres per year with an approximate mean of 300 metres. From present maps it seems that glaciers and shelves occupy less than half of the periphery of the continent, the other half being the slow-moving sheet with an approximate speed of 20 to 40 metres per year. The mean annual movement for the edge of the continental ice may thus be less than 200 metres per year.

The rate of outward flow decreases with depth, but both vary considerably, the thickness at the periphery ranging from ice cliffs of a few metres to more than 1000 metres in some of the big ice streams. The ice shelves increase from less than 200 metres thickness near the outer edge to more than 400 metres near the submerged coast. The American[20] seismic soundings on the Ross Ice Shelf show depths of more than 400 metres near the Beardmore Glacier and on the opposite side of the continent; Robin[21] found that the Maudheim ice, where it meets the sea, is nearly 500 metres thick. The decrease from an approximate mean thickness of 450 metres to the thickness of the icebergs is due to lateral spreading and to melting. Sverdrup[22] found at the Maudheim shelf that the temperature of the sea was 0·3° C above its freezing point so that extensive wastage by melting will take place at the ice surface in contact with the sea. The 450 metres mean thickness of the seaward moving ice may be divided into 200 metres thickness at the ice front where calving produces bergs and 250 metres thickness that is melted away by the sea. This estimate of wastage, divided by the area of the continent, removes accumulation equal to 4 and 5 gm/cm.^{2} respectively.

At the landward edge of part of the Ross Ice Shelf, Debenham[23] found fish, rock debris and Glaubers salts apparently brought up after freezing on the underside of the ice. This suggests that melting at the seaward edge decreases as the land

is approached. Furthermore, measurements by the Americans in a 1000 feet borehole showed a decrease of temperature with depth. The heat from the earth, plus the heat generated by the friction of ice movement, must raise the temperature of the sub-surface of the ice over the continent, but it is difficult to appreciate any warming of the ice sufficient to cause melting, since the heat required seems so much greater than what is probably produced by the general geothermal gradient and the friction of the slowly moving ice dome.

The wastage by these mechanisms, expressed as a weight per square centimetre of area of the continent which can be set against the net accumulation, totals 9 grams, made up of calving 4, melting 5. The amounts of wastage have not been adjusted by the difference between the densities of ice and water because the error in the total assessment must be very great and the estimate has purposely erred to give apparent maximum figures. Even so, the accumulation exceeds the wastage by 4 gm/cm.^{2} yr., which suggests a building up of the ice sheet over Antarctica, not yet manifest at the edges save by the stalemate, the halt in recession.

Errors in the interpretation of snow accumulation, of ice-flow, and of bottom-melting are inherent in the above transect of climate and the budget of Antarctic ice. Modifications are being made as more data from I.G.Y. become available, but the positive balance of the ice mass is such an unusual first result that another expedition is surely warranted.

Acknowledgements.—Dr. D. J. Newell of the Department of Industrial Health, King's College, Newcastle-upon-Tyne, kindly undertook the variance analysis quoted of the data on snow accumulation. Thanks are due to the members of the Commonwealth Trans-Antarctic Expedition who assisted with the field-work, and to the leader and committee for permission to publish this summary. Full scientific results will be written in a series of Expedition publications.

REFERENCES

[1] Lister, H., "Glacier regime in north-east Greenland," in "British North Greenland Expedition, 1952–4: Scientific results," *Geogr. J.*, **122**, 2 (1956), pp. 230–7.

[2] Von Melchior, Schild, "Schnee, Lawinen und Gletscher." Separatabdruck aus 'Jahrbuch,' Weber Heiden, Zürich, 1950, pp. 1–48.

[3] Schytt, V., 'Norwegian-British-Swedish Antarctic Expedition, 1949–52, Scientific Results,' p. 25: Vol. IV, Glaciology II. Norsk Polarinstitutt, Oslo, 1958.

[4] Stephenson, P. J., and H. Lister, "Preliminary results of the glaciological work of the Trans-Antarctic Expedition, 1955–8," *J. Glaciol.*, **3**, 25 (1959), pp. 426–31.

[5] Bull, C., p. 715 in "The use of the Rammsonde as an instrument for determining the density of firn," *J. Glaciol.*, **2**, 20 (1956), pp. 714–18.

[6] Fuchs, V. E., "The Commonwealth Trans-Antarctic Expedition," *Geogr. J.*, **124**, 4 (1958), pp. 439–50.

[7] Meinardus, W., "Klimakunde der Antarktis" in W. Köppen and R. Geiger, 'Handbuch der Klimatologie,' Bd. IV (C), Berlin, 1938.

[8] Giovinetti, Mario, Private communication, July 1958.

[9] Loewe, F., p. 72 in "Precipitation and evaporation in the Antarctic," chap. 5, pp. 71–89, in 'Meteorology of the Antarctic,' ed. by M. P. van Rooy. Weather Bureau, Department of Transport, Pretoria, South Africa, 1957.

[10] Shoumsky, P. A., Summary report, I.G.Y. Symposium on Antarctic Research, Wellington, N.Z., 1958.

[11] Péwé, T. L., *ibid.*

[12] Swithinbank, C., p. 116 in "Morphology of the inland ice sheet and nunatak areas of western Dronning Maud Land," in 'Norwegian-British-Swedish Antarctic Expedition, 1949–52, Scientific Results,' Vol. III, Glaciology I, Part D. Norsk Polarinstitutt, Oslo, 1959.

[13] Liljequist, G. H., p. 203 in "Wind structure in the low layer," in 'Norwegian-British-Swedish Antarctic Expedition 1949–52, Scientific Results,' Vol. II, Meteorology, Part 1C. Norsk Polarinstitutt, Oslo, 1957.

[14] Wright, C. S., and R. E. Priestley, p. 133 in 'Glaciology: British (Terra Nova) Antarctic Expedition 1910–1913.' London, 1922.

[15] Gould, L. M., p. 20 in "Antarctic prospect," *Geogr. Rev.*, **47**, 1 (1957).

[16] Swithinbank, C., p. 75 in "Ice shelves," *Geogr. J.*, **121**, 1 (1955).

[17] Dolgouchine, L. D., p. 121 in "Les particularités morphologiques essentielles et les régularités des mouvements des glaciers de la marge de l'Antarctique orientale (d'après les observations (les relevés) dans la région des travaux de la partie continentale de l'Expédition Complexe Antarctique de l'Académie des Sciences de l'U.R.S.S.)—Physique du mouvement de la glace." *Gen. Ass. int. Un. Geod., Chamonix* (1958), pp. 105–10.

[18] Shoumsky, P. A., p. 8 in lecture on Antarctica delivered to 5ième Comité Spécial Année Géophysique Internationale (C.S.A.G.I.), Moscow, 1958.

[19] Mellor, M., p. 221 in "Australian contributions in Antarctica: Preliminary report." *J. Glaciol.*, **3**, 24 (1958), pp. 279–85.

[20] Bennett, H., Summary report, I.G.Y. Symposium on Antarctic Research, Wellington, N.Z., 1958.

[21] Robin, G. de Q., 'Norwegian-British-Swedish Antarctic Expedition 1949–52, Scientific Results,' Vol. V, Glaciology III. Norsk Polarinstitutt, Oslo, 1958.

[22] Sverdrup, H. U., "The currents off the coast of Queen Maud Land," *Norsk geogr. Tidsskr.*, **14** (1953), pp. 239–49.

[23] Debenham, F., p. 74 in 'In the Antarctic.' London, 1952.

II. THE SEISMIC AND GRAVITATIONAL INVESTIGATIONS

GEOFFREY PRATT

THE WRITER'S GEOPHYSICAL WORK on the Trans-Antarctic Expedition included measurements of the tide at Shackleton Base, seismic sounding of the ice thickness along the route across the continent and also gravimetry. It is the seismic and gravitational work which is considered here.

At Shackleton Base, near the edge of the Filchner Ice Shelf, some time was devoted to putting the finishing touches to the apparatus and installing it in Sno-Cat "Haywire." The camera performed disappointingly in view of its behaviour in cold chamber tests in England, and an internal heater had to be fitted. Also, a field technique had to be evolved, both from the standpoint of discovering the best instrumental settings and so on, and also for using the available helpers to the greatest advantage. Much experimental shooting was done, and finally a short reflection line 1980 metres long was observed.

A month was spent at "Southice" adapting this technique to the somewhat different conditions encountered there at 1500 metres above sea level, on the edge of the polar plateau. A refraction line 3525 metres long was also shot, for determining the velocity distribution in the ice and in the bedrock immediately underneath it. This was finished just in time for us to leave on Christmas Day 1957 for the main journey. On this journey thirty-four seismic stations were occupied for reflection shooting; one of these has so far defied all attempts to interpret the results, but the rest give thicknesses well supported by the gravity measurements. The results from this section of the work are shown in Figure 4; it can be seen that the bottom of the ice dips below sea level in only two places. Usually Dr. Lister bored a hole 12 metres deep for his glaciological work and this was used subsequently as a shot-hole; sometimes, however, surface shots were fired. Perhaps the most

interesting records from this main journey were those taken at the South Pole itself, the point in their case being that it is the only instance in which two separate parties have shot the same spread in the Antarctic. The thickness of the ice according to the Expedition's work is about 1900 metres, some 800 metres less than the figure published by the United States expedition "Deep Freeze." The accuracy claimed at this stage for the thickness measurements on the ice cap is ± 60 m. (200 feet); when all the reductions are complete it is hoped to get nearer to ± 30 m. (100 feet). This is a lower accuracy than most other people have claimed, but it is probably of the right order for all Antarctic work. There is, in addition, the possibility of error due to wrongly identified reflections; in the case of isolated shots not forming part of a line this may cause almost unlimited exaggeration of the depth, but is unlikely to lead to under-estimation.

The refraction line at "Southice" was laid out over gently undulating country; its 3525 metres of length straddled two valleys about 5 and 10 metres deep. The seismic arrivals show a slight tendency to come in earlier on the tops of the ridges than in the valley bottoms. Although the effect is too small to be statistically significant, it is reasonable—assuming the valleys to contain a relatively deeper layer

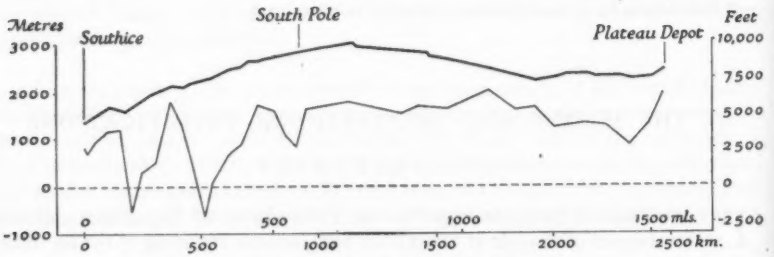


Fig. 4. Seismic profile across Antarctica

of unconsolidated snow. There was no time available to shoot the line twice, in opposite directions, so that it is not possible to interpret it uniquely in terms of ice thickness and so on. When shot in a single direction only two relationships can be found between the three unknown quantities—namely ice thickness, dip of its bed, and seismic propagation velocity in the bed. Limits can be set, however, to these three:

Thickness at shot point	850–420 metres
Dip to the north	−14°–+15°
Refractor velocity	4·43–6·5 m/msec.

The first of these limits is set by the need for the ice thickness at the farthest geophone to be positive, since the bedrock is known not to outcrop; the second limit is imposed by the refractor velocity which would otherwise have to soar absurdly high. Reflection shots at "Southice" give the thickness as 530 metres; this information added to the refraction data shows that the bottom of the ice is substantially level, and that the true bedrock velocity is nearly 5·0 m/msec.

It is necessary to calculate the velocity distribution as a function of depth below the snow surface, because all the other work is dependent on corrections derived from it. The vibrations from a shot travel to the geophones along curved rays, at first going downwards fairly steeply but flattening out in the ice not very deep below

the surface; the rays eventually bend up to the geophones rather at the last moment. It is easily shown that the velocity at the greatest depth reached by the ray is equal to the velocity with which the arrivals run along the line of geophones, and this is very quickly found from the refraction records. Calculating the depth to which any particular ray has penetrated is a comparatively lengthy computation; although straightforward, it involves a long numerical integration. The end product of all this is a pair of values—a depth and the velocity corresponding to it. The whole thing is repeated for other rays, until sufficient pairs of values have been found from which to plot the velocity as a function of depth. It was found at "Southice" that the surface velocity was 0·58 m/msec., and that it increased asymptotically with depth towards 3·94 m/msec.; this is near the value for pure ice, and was reached 100 metres below the surface.

Most of the corrections mentioned early in the last paragraph are evaluated with the help of simplifying assumptions. This practice is usually forced on the computer not merely by expediency, but also because the full details of the velocity distribution are not known, so that nothing more rigorous is possible. Several different kinds of corrections were calculated both rigorously and conventionally; where the accuracy was sufficient the simpler methods have been used in all the subsequent reductions, but where a significant difference was apparent the accurate methods were used even though they are laborious to apply.

The work done on the ice shelf at Shackleton posed two problems. An excellent reflection at about 1400 msecs. was always recorded, presumably from the sea bed; a very poor reflection at about 220 msecs. from the bottom of the ice shelf could occasionally be imagined if one knew where to look for it. In between, a series of quite strong multiple arrivals occurred on a minority of the records. The origin of these undependable reflections is the first of the problems and as yet remains unsolved. The second problem is the classical one in ice shelf interpretation—to determine the separate thicknesses of both the ice shelf and the sea water when reflections are only obtained from the sea bed. If there is assumed to be a single layer only above the sea-bed reflector, its velocity $\bar{V}$ can be determined from the move-out of the reflection; that is, from the change in time with varying distance between shot point and geophone. There are routine methods of doing this, such as Opitz's graphical procedure, or using least squares to fit T^2 to a quadratic expression in X (the geophone distance). The dip β of the reflector can also be found, and the two-way reflection time T_0 recorded by a geophone at the shot point. If we now decide that there is not a single layer but an upper plane-parallel one (ice) with velocity V_1 and a lower one (sea water) with velocity V_2 and bottom slope α, the rather naïvely computed $\bar{V}$ and β can be used to give more realistic data:

$$D_1=\tfrac{1}{2}\,V_1T_0\frac{\bar{V}^2-V_2^2}{V_1^2-V_2^2}\cdot\frac{\bar{V}^2-V_1^2\sin^2\beta}{\bar{V}^2\cos^2\beta}$$

$$D_2=\tfrac{1}{2}\,V_2T_0\frac{\bar{V}^2-V_1^2}{V_2^2-V_1^2}\cdot\frac{\bar{V}^2-V_2^2\sin^2\beta}{\bar{V}^2\cos^2\beta}$$

$$\sin\alpha=\frac{V_2}{\bar{V}}\sin\beta$$

D_1 and D_2 are thicknesses traversed by the "central ray" which is reflected back to the shot point. It is found in the case of the ice shelf at Shackleton that D_1+D_2 (the depth to the sea bed) is some 10 per cent. less than the value found directly from single-layer theory.

The least squares determination of ∇ gives an estimate of its accuracy, which can be used to estimate the reliability of D_1 and D_2. The ice thickness proves to be of the order of 380 ± 80 metres, which is slightly greater than would be expected from the surface elevation of 50 metres above sea level, on the basis of density measurements made by the Norwegian-British-Swedish Expedition (1949–52) at Maudheim. However, the seismic velocity profile shows the near-surface layers to be more compacted at Shackleton, so that the discrepancy is in the right direction.

The gravimetry confirms the seismic work, because the Bouguer anomalies calculated, using the seismic thicknesses, show a reasonable amount of regional variation. The provisional heights contribute an uncertainty of 25–50 mGal., and the drift of the Worden gravimeter about 5 mGal. The drift, of course, could only be measured at night camps; its value whilst travelling had to be estimated so as to fit the check points at the South Pole and the two ends of the journey. Nevertheless, the Bouguer values work out at -100 to -200 mGals., so that the overall picture is undoubtedly one of a region having large negative anomalies. This presumably means that the continent is still rising fast under the relief of a disappearing ice age, considered as a general trend through geological periods of time. What is happening during short periods (such as the present century) is altogether another question.

DISCUSSION

Afternoon Meeting, 23 February 1959

Sir JAMES WORDIE, Master of St. John's College, Cambridge, took the Chair and introduced the speakers: Dr. H. Lister, glaciologist, and Mr. Geoffrey Pratt, geophysicist, of the Commonwealth Trans-Antarctic Expedition.

After Dr. Lister and Mr. Pratt had spoken, the Chairman opened the meeting to discussion.

Dr. CHARLES SWITHINBANK (Scott Polar Research Institute): Dr. Lister's diagram of sastrugi directions suggests that easterly winds prevail over much of the route from "Southice" to the Pole. Is there any evidence to suggest that these are katabatic winds blowing towards a low-lying area between the Ross Ice Shelf and the Weddell Sea?

Mr. W. V. LEWIS (Department of Geography, Cambridge): It has been a pleasure to hear from Mr. Pratt and Dr. Lister something of the scientific results of the Trans-Antarctic Expedition, which shows that this expedition has been as successful in the field of science as it has been in the fields of exploration and of physical achievement.

Dr. Lister's reference to the rounded "bullet" shape of the ice crystals which he examined after they had been deposited in the firn interested me. In a previous lecture to this Society he mentioned two important facts, first that the prevailing direction of these ice crystals in the firn was perpendicular to that of the prevailing wind, and second that their horizontal velocity when airborne was about half that of the wind. In my semi-ignorance I had assumed that this direction was to be expected, *i.e.* that such crystals would tend to align themselves transverse to the direction of the wind which drifted them. This, I thought, was due to the fact that, if one assumes an initial random orientation for these crystals as they fall towards the ground, those with their long axes parallel with the direction of the wind would be unstable in direction. This is because any slight deflection from this direction would cause a rush of air round the outer side of the up-wind end of the crystal, leading to an increase of velocity and a decrease of pressure which would tend to produce a force, p_1, which would further increase this deflection.

The down-wind end of the crystal would be subject to a similar turning moment,

p_2. Also, the direct impact of the air stream on the side of the up-wind end of the crystal opposite to p_1 would give rise to a force p_3. This again would have little or no corresponding, but correcting, force at the down-wind end. Therefore a turning moment would tend to be exerted by the wind until the crystal axis lay transverse to the wind direction and, consequently, this latter direction would be the more stable, *i.e.* that which most airborne crystals would tend to follow. (See Fig. 5.)

As this suggestion was new to Dr. Lister, I decided to check it with the experts and found it was by no means familiar to them either! However, Dr. G. P. Batchelor of Trinity College, an authority on turbulence and related phenomena, eventually enlightened me by stating that as long as the particles were being accelerated, the action I envisaged would occur and the crystals would tend to have their long axes aligned perpendicular to the direction of the wind.

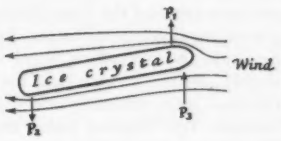


Figure 5

Dr. Lister's evidence that the velocity of the crystals approximated to half the velocity of the wind showed that the crystals were in fact being accelerated when they were airborne, and today Dr. Lister has confirmed this interesting finding by showing that the bullet shaped crystals, dropped in the firn, had had their ends and corners blunted by repeated bouncing on the surface of the firn. This is why their velocity was very much less than that of the wind which carried them, and why they tended to be aligned transverse to the direction of this wind. So, I think that in this matter Dr. Lister has given us a consistent and revealing picture of the drift conditions of these "needle" or bullet shaped ice crystals.

Professor GORDON MANLEY (Bedford College) congratulated Dr. Lister on the ingenuity with which he had tackled the fundamental problem of the existence of the Antarctic ice sheet, starting from field measurements. He wondered whether he had yet been able to relate his findings with regard to the variation in the mean annual accumulation at "Southice" to those of other workers on possible variations in the world atmospheric circulation; probably Mr. Lamb would also wish to comment on that question. Mr. Jeremy Smith[1] who had carried out I.G.Y. glaciological studies on South Georgia was working up his material from that island, where the glacier behaviour in the past 80 years might well throw further light on what had happened around the margins of the continent.

Mr. H. H. LAMB (Air Ministry, Meteorological Office) expressed great interest in the trend of accumulation on the ice cap at "Southice" shown by Dr. Lister in Figure 1. He pointed out that this trend, with its maximum of accumulation in the 1920's, and subsequent decline by about 30 per cent. to a rate similar to that prevailing around the turn of the century, ran broadly parallel with the trend of intensity of the atmospheric circulation over the world as a whole, according to results lately arrived at in the climatological research division of the Meteorological Office at Harrow. Parallelism of these two trends should be expected since the more intense the large scale atmospheric circulation the more moisture (and heat) supply there should be from low to high latitudes. So the trends of accumulation in the remotest regions of the Antarctic and Greenland ice caps, reported by Dr. Lister, may provide a nice verification of our ideas of the trend of intensity of the atmospheric circulation in terms of one of its consequences. However, to be on safer ground he would like to know the probable margin of error in dating the maximum snow accumulation at "Southice": could one be sure it was in the 1920's? And, when it was stated that the rate of accumulation recently has been about the same as that prevailing about 1900, or a little earlier, did the specification 1895–1900 (taken from

[1] The death of Jeremy Smith while climbing Mont Blanc in August 1959 will be remembered. The results of his work in South Georgia were being prepared for publication and it is hoped that they will soon appear.—*Editor*.

the diagram) allow a sufficient margin of error for the difficulties in identifying all the annual layers and so arriving at the date?

The picture of prevailing surface winds over Antarctica provided by the snow dunes and smaller sastrugi observed on the crossing by the Trans-Antarctic Expedition was also valuable. The prevailing winds appeared to be mainly a resultant of the general anti-clockwise circulation around the anticyclones commonly centred over the middle of the ice cap and the katabatic wind component, *i.e.* the tendency for cold air to run down-slope and drain outwards off the ice dome by all the natural drainage channels. There was a complication apparent in the arrows for the sastrugi on Figure 2: the southerly winds prevalent in the Ross Sea sector and in Terre Adélie were seen to begin beyond the Pole, between 87° and 90° S. on the Weddell Sea side, where the prevailing direction changes quite rapidly. Between this point and 88° S. on the Ross Sea side the prevailing wind was apparently up-slope (although the slope was very slight): on this stretch near the Pole the prevailing winds around the Antarctic anticyclones were probably affected by the catchment of air feeding into the broad trough between the Victoria Land mountains and the main ice dome in East Antarctica. This supplied the formidable katabatic winds of Terre Adélie and much of East Antarctica.

Mr. Lamb also congratulated Dr. Lister on his estimation of the state of balance of the Antarctic ice sheet as a whole. Dr. Lister was certainly right to treat the quantities of snow lost over the coast in the Terre Adélie blizzards as far too great to be representative of the whole coastline of Antarctica. (They were related to the unique prevalence of south-south-east winds in that sector.) Other items in the balance sheet would no doubt be debated for a long time to come, but the estimates of accumulation over the interior based on the glaciological observations were a new contribution of real value.

Dr. H. Lister: In answer to Professor Manley: the data on accumulation at "Southice" have only been compared with data from "Northice." More observations are required over the continent to be able to assess the changes in accumulation and compare these with changes in precipitation values from other parts of the world. Jeremy Smith's data from South Georgia give more precise stages of recent glacier recession than have been found on the mainland.

Dr. Swithinbank's suggestion of a possible trough between the Weddell and the Ross Seas causing katabatic winds is probably true, but the principal influence on the wind direction seems to be the anti-clockwise motion around the high plateau centred near the Pole of Inaccessibility. As Mr. Lamb points out, the central anticyclone and the topographical trough towards Terre Adélie overcomes the influence of a possible valley linking the Weddell and the Ross Seas so that, before the Pole is reached, and subsequently towards the Ross Sea, the sastrugi directions along both the T.A.E. route and Scott's route show a change in direction away from any Weddell-Ross Sea trough.

Mr. Lamb's query on errors is very pertinent. The standard deviation across the continent has been given, but the error in estimation of an annual layer in any one snow pit possibly amounts to 50 per cent. The many observations at "Southice" improve this figure since an over-estimate of one layer may be countered by an under-estimate of the next; the five-year running means spread these errors. It is quite possible to be one year in error in the dating of five or six successive layers, so that at the turn of the century the error in the dating could be ten years.

Mr. Lewis's analysis of the instability of the elongated crystals lying only partly across the wind explains some of the pattern found by Dr. Stephenson in the petrofabric study of the firn. However, the preferred orientation was very weak, possibly because of the preponderance of nearly equi-dimensional drift particles.

GEOMORPHOLOGY IN AUSTERDALEN, NORWAY

CUCHLAINE A. M. KING

DURING THE PAST five years, from 1954 to 1958, survey work has been carried out and observations made by a number of parties in various parts of the glacier system of Austerdalsbre and in the valley below the glacier. The area studied, shown in Figure 1, lies on the south side of the Jostedalsbre ice cap between the Nordfjord and the Sognefjord. Austerdalsbre drains south from the ice cap through the two ice falls of Odinsbre and Thorsbre; a third ice fall, Lokebre, is no longer directly connected with the glacier trunk, which is about two miles long (see Fig. 2, folding map). Below the snout there is a fine series of terminal moraine arcs and an interesting series of rock bars and basins, which continue beneath the waters of Veitestrondsvatn, a lake about 11 miles long. This lake is dammed up by another rock bar across the valley before it opens out to the gentler slopes around Hafslo, where a second lake is situated. The river draining Hafslovatn descends by a series of rapids and falls over a rock step about 550 feet high to one of the heads of the Sognefjord near Sogndal, as shown on Figure 1 (p. 358).

The major part of the work done in the area has been devoted to fundamental glaciological research, some of the results of which have been published already.[1–9] There remain, however, many data of interest and a series of surveys carried out in various parts of the valley below the glacier and on the ice itself. An attempt has been made to correlate most of these surveys and to produce a map covering the whole of Austerdalsbre from the terminal moraines of 1750, near the rock bar above Tungaseter, to the crest of the ice falls which drain from the ice cap of Jostedalsbre. This map, Figure 2 (facing p. 368), illustrates the general nature of the valley. The height and steepness of the ice fall is shown and the character of the glacier tongue and snout is apparent. In the valley recently vacated by the retreating glacier, evidence of its earlier length is clearly visible in the numerous terminal moraines, shown in the lower part of the map. Most of these moraines were surveyed by A. Young. The theodolite triangulation used as a basis for the whole map was carried out mainly by the Cambridge Austerdalsbre Expedition in 1955. Much of the detail on the main glacier tongue was surveyed by a Brathay Exploration Group in 1954, and this was supplemented and adjusted by theodolite triangulation, carried out in 1955 and 1956. Details of the ice, including most of the ogives, were surveyed by parties from the Perse School, Cambridge, and by the Brathay Exploration Group in 1956. The ice falls of Odinsbre and Thorsbre were surveyed by plane-table, based on the theodolite triangulation, in 1957, while the glacier snout was surveyed by plane-table as an independent survey in 1958. This was fitted to the rest of the map by using the Brathay triangulation stations. The painting of these survey marks, often in very inaccessible places on the rock walls, has greatly facilitated all the survey work on the glacier. They are shown on Figure 2.

The dating of the terminal moraines is based partly on historical evidence and partly by comparison with Nigardsbre moraines. Moraine dates obtained by tree ring and lichen examination by P. J. Walker in 1956 support the findings of A. Young, who has correlated Faegri's dating of the succession of the moraines of

west Norwegian glaciers, particularly Nigardsbre, with those of Austerdalsbre. This work is not published. The other data available include a longitudinal valley

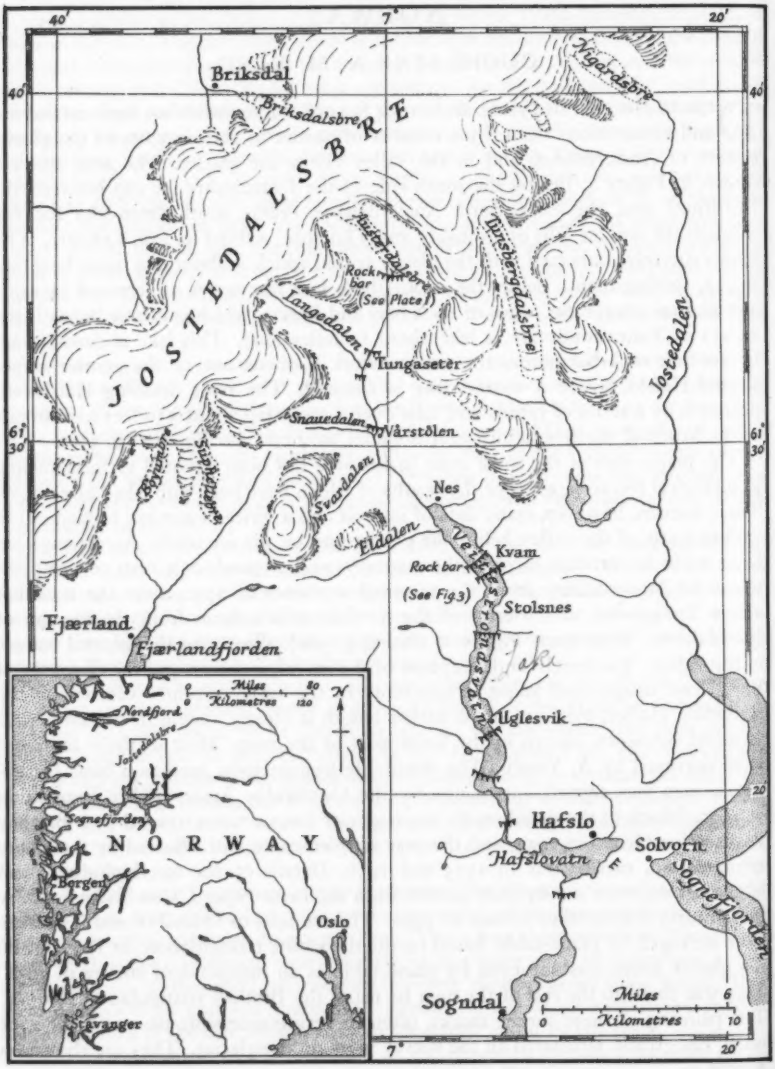


Figure 1

profile, levelled in 1956 from the base of the ice fall, above the point CO (see Fig. 2) near the foot of the ice falls, to the glacier snout and down the valley to a position at the head of Veitestrondsvatn, shown in Figure 5. The survey continues as a series

of echo-sounded lines, extending the complete length of the lake, a distance of about 11 miles. Fifteen cross profiles of the lake were also sounded. This survey was carried out by a party of students from Nottingham University, led by R. F. Tomlinson. Survey work and observations were also carried out by this party and one from Imperial College, London, under D. Taylor Smith, in the accumulation area of the glacier. A gravity survey of the main glacier to determine the thickness of the ice was carried out by C. Bull and J. R. Hardy from Cambridge.[2]

These data provide interesting evidence on the effect of glacial action in the valley and subsequent modification of the land forms. A number of features of special interest stand out, which will be considered briefly; these include:

1. Rock basins, rock bars and valley steps.
2. Moraines and associated retreat stages.
3. Characteristics of the valley walls.
4. Non-glacial modifications.

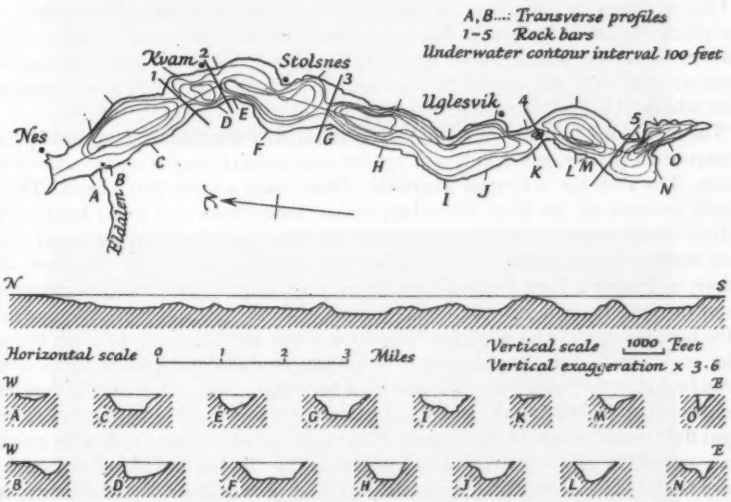


Fig. 3. Soundings in Veitestrondsvatn

Rock basins, rock bars and valley steps.—Austerdal illustrates very clearly the irregular longitudinal profile usually associated with glaciated valleys. Very conspicuous rock bars are found in the valley; four of these, which lie between the top of the lake and the glacier snout, are considerably modified by post-glacial erosion. Their position and those further down-stream are shown in Figure 1. In Veitestrondsvatn five further rock bars are clearly revealed by the soundings, which are shown in Figure 3. A rock bar also dams up the lake. All these features are solid rock bars; in the lake, where they have not been partially buried or cut through by river action, the basins are almost equally deep both up-stream and down-stream of the rock bar, which forms a fairly symmetrical bar in longitudinal section.

Rock bars and valley steps are usually explained either by the outcrop of harder rock bands across the valley, or by constriction of the valley walls, or by tributary junctions in the valley.[10] Because the whole area under consideration consists of

massive gneissic rocks, which do not appear to differ substantially from place to place, and in which joint frequency is apparently not very uneven, the first explanation does not account satisfactorily for the development of rock bars. It is, therefore, probable that the valley characteristics account for them.

The relation between the movement of a glacier and its capacity to erode its bed depends on several factors, which are not fully understood. Erosion probably increases with both increased speed of flow, particularly along the glacier bed, and with the thickening of the ice. It may also possibly be more effective where the flow is compressive, which normally occurs when the bed is concave and the flow decelerating. It may be less effective where the flow is extending, which occurs if the bed is convex and the flow accelerating, according to Nye's analysis.[11] That this type of flow is closely associated with the form of the bed, in a fairly thin glacier, has been demonstrated by observations made by Nye under the ice fall of Odinsbre in 1956 and 1957.[6] Over the distances considered, the variations of accumulation and ablation can be ignored.

One of the main difficulties of explaining rock bars in terms of the capacity of the glacier to erode its bed is due to the fact that the relative importance of the various factors on which erosion probably depends is not known. It does appear, however, that bars and associated steps are more likely to occur in some situations than others. The rock bars in Austerdal illustrate some of these situations.

The first of the four rock bars in Austerdal has only recently been exposed by the retreat of the glacier, which still rests against rock slabs of the bar on the west of the snout. The rock bar is formed where the glacier takes a fairly sharp bend. This is clearly revealed by the form of the bar, which slopes down to a lower level on the outside of the curve; the ice here has cut away the valley wall, leaving a very steep rock slope rising abruptly from the recently deposited moraine. The rock face shown in Figure 2, now forms a bluff which must have caused considerable piling up of the ice stream shown in the photograph (Plate 1). It is not possible to determine how far the reverse slope has been eroded as it still lies partly beneath the ice. The rock bar has the appearance of a greatly modified pre-glacial valley spur, extending into the valley from the inside of the bend. Such a spur would constrict the glacier in negotiating the bend and cause some piling up of ice behind. More rapid flow would occur on the outside of the bend, possibly causing greater erosion here, especially as a relatively large proportion of the ice would be expected to move round the outside of the bend and its thickness would also be relatively great.

The second rock bar crosses the valley just above Tungaseter; it forms a broad, steep barrier across the valley, through which the river has sawn a gorge. It is shown on the longitudinal valley profile as a marked increase of gradient (see Fig. 5). The basin on the up-stream side of the bar has been partially filled by detritus brought down by the meltwater stream, but a considerable step separates this partly filled basin from the flat area around Tungaseter. This is another partially filled basin, formed up-stream of the next rock bar, which is found just down-stream of Tungaseter. The step above the seter could represent the hang of Austerdalen to Langedalen. The step below Tungaseter occurs just below the junction of the two valleys. It is a relatively minor feature, possibly resulting from increased erosion below the junction of two ice streams.

A few miles down-stream a large, solid rock bar crosses the valley near Vårstölen. Here a major tributary valley, Snauedalen, at the head of which a col crosses to Fjaerland, enters the main valley just down-stream of the bar. Both valleys must have carried large amounts of ice, but Snauedalen hangs slightly to Austerdalen.

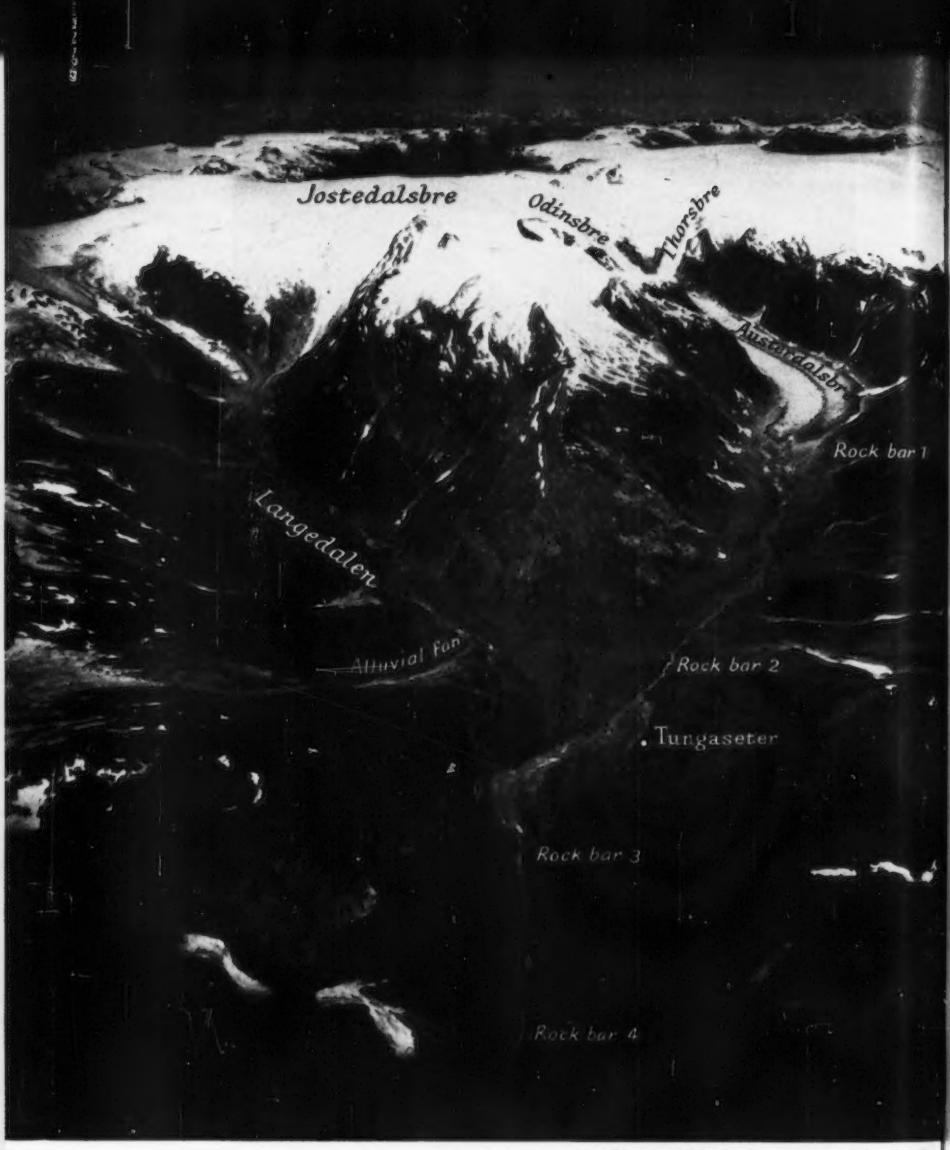
Photograph: W. Evers

June 1937

Photograph: J. F. Nye

July 1957

1. Austerdalsbre: The snout, taken from moraine G, formed about 1909, near Base Camp; moraine H in middle distance



Photograph by kind permission of Dr. W. Ev

2. Aerial view of Austerdalen and Langedalen from Vårstölen, up-stream, and showing Jostedalsbre with Odinsbre and Thorsbre draining from it to form Austerdalsbre

There are no further rock bars down-stream of Vårstölen until Veitestrondsvatn is reached. The absence of rock bars, associated with the hanging valleys, Svardalen and Eldalen, must be considered. The latter, in particular, is an important through valley, which enters Austerdalen just below Nes (see Fig. 1). It is possible that rock bars, associated with these valleys, may be hidden beneath the alluvium which fills the lower part of the valley at the head of Veitestrondsvatn. The basin at the head of the lake above Kvam may be due to the increased erosion associated with the additional ice coming through Eldalen.

Submerged beneath the lake five further bars were found by echo-sounding. They are shown in Figure 3, which was prepared from data obtained by R. F. Tomlinson. Some of these bars may be related to the presence of bends in the valley and are, therefore, comparable with the bar at the present glacier snout. Two rock bars separating three basins occur round the corner near Kvam. The third bar is found just down-stream of the peninsula of Stolsnes, where the glacier had again to negotiate a bend. The fourth bar, near Uglesvik, breaks the surface of the lake in two small islands, which testify to the solidarity of the rocks forming these bars. The last bar in the lake occurs a mile further down-stream, again at a bend in the valley, near the point where a tributary enters from the west.

The final bar in the series dams up the lake. It is much higher than those submerged beneath the lake, whose sill depths are between 100 and 200 feet for the upper three, and under 100 feet for the lower two. The intervening basins reach depths of about 300 to 400 feet. They are, therefore, relatively minor features in a major rock basin, forming the whole of the lake. The bar holding in the lake also occurs at a point where the valley is very narrow, before it opens out into the broad vale of Hafslo. The ice clearly travelled from this broad basin by diffluent streams to both Solvorn and Sogndal. There are rock bars on both sides of the basin of Hafslovatn, below which steps lead down to both Solvorn and Sogndal. The steps, which are about 550 feet high, represent the hang of the valley of Hafslo to the main trench of the Sognefjord, down which much ice must have passed from Jostedalen and the mountains to the east. Subsequent erosion of the rock bar damming Veitestrondsvatn by the stream draining the lake appears to have lowered the level of the lake by about 200 feet. The character of the deposits found above Nes supports this view; those less than 200 feet above the lake have been deposited mainly in still water, while those higher show signs of deposition by running water.

One difficulty in the consideration of rock bar formation is the unknown form of the pre-glacial valley. Austerdalen is a deeply incised, typically U-shaped glaciated valley, but the amount of deepening achieved by the glaciers is not known. Evidence of late pre-glacial uplift would suggest that vigorous stream action had already carved deeply into the uplifted peneplain, which is clearly visible in the Jostedalsbre area today,[12] shown on Plate 2. It is likely that a youthful valley would have irregularities in its profile and cross-section, which might help to initiate the formation of rock bars under moving ice. The fact that steps and bars are preserved under the glacier shows that glacial erosion forms rather than destroys them. They are soon modified by fluvial erosion when exposed from the ice.

The largest step in the whole valley, which may well represent in a modified form the major pre-glacial knick-point, is the rock wall over which the ice falls of Odinsbre and Thorsbre drop to the glacier trunk below (see Fig. 2, and Plate 2). This feature has clearly been widened, and probably cut back, by the action of the fast flowing ice of the ice fall. Measurements have shown that the ice is moving at over 3280 feet (1000 m.)/year in the centre of the ice fall, increasing to

6560 feet (2000 m.)/year above and falling to about 1640 feet (500 m.)/year towards the bottom. The step is about 2500 feet high and separates the firn-covered accumulation zone from the glacier trunk, the present firn line runs approximately across the top of the ice fall. The surface slope of the ice fall is about 1 in 1·56 and, according to the depth to which a pipe was sunk in 1956, the ice is about 131 feet thick near the bottom of the ice fall. It must be much less thick near the top, where Nye has calculated a depth of 20 feet.[5]

If this step were a modified pre-glacial knick-point the valley gradient would initially have been steeper in this vicinity, below the knick-point. This would cause an acceleration of the glacier flow and increased bed-slip, with increasing ice thickness towards the bottom of the steeper section. This may have produced a zone of maximum erosion, thus steepening and emphasizing a pre-glacial change of gradient in the valley. Similar features can be seen in several other neighbouring valleys; for example, Langedalen (Plate 2) and Briksdalen. Whether a basin lies above the step is not known, as it is covered by crevassed ice, but it is very likely that a basin will be found to lie behind the rock bar at the brink of the ice fall step.

The position of the rock bars may be summarized thus: they occur at bends in the valley, for example at the snout of the glacier; above tributary junctions, such as that above Tungaseter and at Vårstölen; below tributary junctions, as below Tungaseter; and at constrictions in the valley, for example at the end of Veitestrondsvatn and near Uglesvik. In these situations there must be variations in the rate of flow and thickness of the glacier, the former giving rise to areas of compressive and extending flow. These variations might account for the differential erosion, but until more is known of the relative effectiveness of these variables for glacial erosion the formation of the rock bars and basins cannot be explained in detail.

Moraines and associated retreat stages.—A series of arcuate terminal and lateral moraines lies in the valley of Austerdal between the rock bar just above Tungaseter and the present glacier snout, and is shown on Figure 2. These deposits represent fluctuations in the glacier during retreat from the post-glacial maximum advance of the ice which, on historical evidence, took place during the first half of the eighteenth century. The glaciers reached their maximum extent about A.D. 1750, when there were many reports of destruction of farm land and houses by the advancing ice.[13] There were eight major and two minor phases of moraine deposition. These features have been dated, and from this evidence it is possible to determine the appropriate rate of retreat of the glacier. The figures of retreat speed will be too low for the maximum rate because each terminal moraine was probably formed during a period of glacial stagnation, or possibly advance, of unknown duration. The form of the moraines indicate that material has been pushed forward into a ridge by the glacier snout. Many of the moraines are symmetrical in form; the steep front slope could represent the angle of rest of material pushed forward by the snow-plough action of the glacier snout, while the steep back slope would be an ice-contact slope formed by the decay or retreat of a steep ice front. This form is typical of an advancing glacier. The gently sloping snout of a static or retreating glacier could not produce such steep terminal moraines. In places, however, the steep back slope has clearly been formed through undercutting by the swinging channels of the braided meltwater river. The fact that no terminal moraines are forming now, during a period of rapid retreat, indicates that these features are formed during periods of stationary or advancing snouts.

The dates of the moraines arrived at by P. J. Walker and A. Young, which are

not published, are as follows; the letters refer to the moraines and are shown on the map (Fig. 2).

Moraine	*Distance from A in feet*	*Date*	*Nigardsbre moraines (Faegri,*[13]*)*	*Retreat*	*feet/year*
A	0	1750	1742–50	—	—
B	1280	1805	1806	A–B	24
b–c ..	1770	1835	1835	B–bc	15
C	2140	1850	1848	bc–C	24
D	2530	1855	1856	C–D	79
E	3170	1865	1862	D–E	64
F1	3840	1875	1875	E–F1	67
F2	4150	1890	1883	F1–F2	21
G	5180	1909	1906	F2–G	55
H	5920	1928	1930	G–H	40
h–i	6610	1937	—	H–hi	79
1958 Snout	8500	1958	—	hi–1958	88

The dates given for Nigardsbre (see Fig. 1), which include all the moraines given by Faegri, show that there is a close similarity between these two glaciers, which both drain south-east from the Jostedalsbre ice cap. The historical data for Nigardsbre are more complete, but the similarity in position and type enables dates to be fitted to the Austerdal moraines. The tree-ring analysis and dating of Walker agrees well with the dates obtained by comparison with Nigardsbre moraines.

The only fully vegetated moraines are the outermost ones deposited around 1750, but all except moraine H, shown in Plate 1, are semi-vegetated with lichens and other plants. Most of the moraines consist of large rounded stones and fine sediment, although some are composed mainly of boulders. The moraine G, in particular, contains enormous blocks of rock, some tens of feet in length. The formation of this particular moraine must represent the deposition of blocks, carried down the glacier, and derived from some very large rock-fall from the very steep valley walls. The blocky moraine at present on the east side of the glacier near point V. E, is probably the result of a similar abnormally large rock-fall, which will in time form a similar moraine at the glacier snout.

Near the snout the moraines become ice-cored. At present there is a collapsed ice arch in the side of which the ice is exposed, but its upper covering of rock debris is several feet thick. This layer of stones and finer debris gradually merges with the ground moraine further down the valley, making it difficult to define the exact edge of the ice. An ice-cored lateral moraine, about 20 feet high, is also found on the edge of the glacier here. The covering of material over the ice is between 6 inches and 1 foot thick and consists of fine sediment and larger stones. The ice-cored moraine, which is indicated on the map (Fig. 2), is limited to that part of the glacier where the medial moraine reaches the end of the glacier on a fairly broad front. Elsewhere the ice near the snout is remarkably clean, particularly where it rests directly on solid rock. In other parts, near Q on the map, a layer a foot or two thick of very heavily laden ice is overlain along a sharp discontinuity by clean ice.

The conspicuous medial moraine (see Plate 2) is a superficial feature on the glacier. Its obvious origin in a glacier of this type is the rocky bastion between Odinsbre and Thorsbre, but the moraine has no surface connection with this rock face. It first appears on the glacier surface a little down-glacier from the point CO,

shown on Figure 2, as a rather diffuse covering of surface debris, mainly on the east side of the glacier. Its appearance at this point may be due to the ablation of the ice, forming the avalanche fan on Thorsbre, which may initially have buried it. It is known that ice in the eastern part of Odinsbre is buried under ice avalanche debris by the disappearance of the pipe, sunk in 1956, for at least two years.

Since 1900 the variations in the length of many of the glaciers draining Jostedalsbre have been measured annually. Unfortunately, measurements on Austerdalsbre were not continuous and were made only during the period 1905–1918 and from 1933 onwards. However, neighbouring glaciers have been measured throughout the period; these are approximately similar in their trends and can be used to fill the gaps in the records for Austerdalsbre. The glaciers which most closely follow the available data for Austerdalsbre are Briksdalsbre and Nigardsbre (see Fig. 1). The changes in the length of all three are shown in Figure 4. The similarity of oscillations of the latter glacier has already been noted, while the curve showing the movement of the snout of Briksdalsbre is very similar to that of Austerdalsbre, particularly in the first part of the period, when Briksdalsbre was longer. Now that Briksdalsbre is reduced to an ice fall along most of its length and a lake has formed at its snout since 1939, its reactions are probably more rapid than those of Austerdalsbre to changing conditions. The similarity of movement is to be expected as the accumulation zones of the glaciers are adjacent; although they flow in opposite directions from the ice cap, they probably receive similar snow falls.

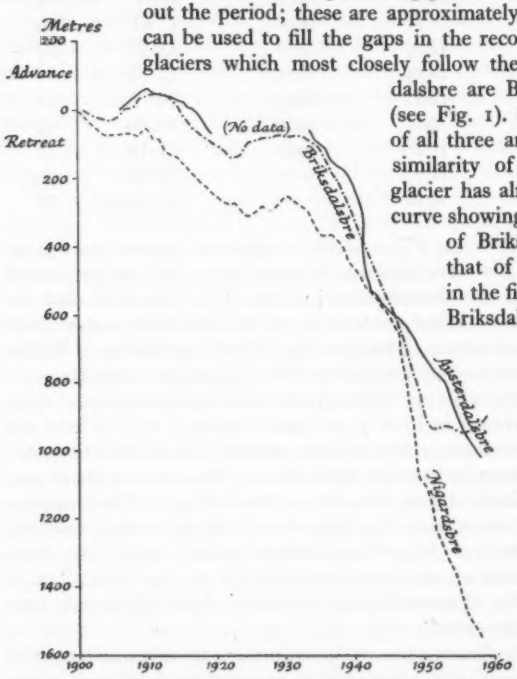


Fig. 4. Fluctuations of the glacier snouts of Austerdalsbre, Nigardsbre and Briksdalsbre since 1900

Since 1900 Briksdalsbre and Nigardsbre both show two major periods of advance, but owing to the lack of observations in the 1920's, Austerdalsbre only shows one advance. Both these periods of advance have resulted in the formation of well marked terminal moraines, which gives good evidence that moraines of this type are formed during advance of the ice. Since the mid 1930's the ice retreat has been accelerated, although the years of maximum retreat vary from one glacier to another, according to their length, accumulation to ablation area ratios, and other factors.

It is interesting to note that Store Suphellebre advanced during 1951/2 and 1952/3 and Briksdalsbre (see Fig. 1), which is the shortest of the three glaciers shown in Figure 4, has advanced for five years between 1950 and 1958 and Böyumbre has advanced in three years. The longer glaciers, such as Nigardsbre and Tuns-

bergdalsbre (see Fig. 1) have not responded to this tendency to advance, but evidence suggests that the firn in the accumulation zone of Austerdalsbre is increasing in area and thickness, because sections in some areas show an unconformity in the banding of the firn, with several years of new firn resting on the folded and truncated layers of older firm. Increasing avalanche activity in recent years from the hanging face of Lokebre, which lies above the west flank of Austerdalsbre between IV. and V. W, just south of White Stone Cairn, may also be due to the thickening and more active movement in the firn area. It has also been shown, by observations made in the summer of 1958, that the ice forming the snout of the glacier is moving forward right at the end, indicating that this part of the glacier does not consist of dead and stagnant ice, decaying *in situ*, but is active ice, although the position of the snout is retreating.

The possible climatic causes of these oscillations may be considered. The winter precipitation figures for Bergen, Briksdal, Fjaerland and Fanaröken show a definite decrease since 1930, with a pronounced minimum in 1940. On the other hand, relatively heavy precipitation was recorded during the period 1905–10 at Bergen and Briksdal, with another maximum about 1913 and for a longer period around 1918 and 1921. Fluctuations of temperature have also been recorded for the same stations since the beginning of the twentieth century. Relatively cold spring temperatures occurred around 1908, with minima about 1917 and 1924; since the latter date temperatures in spring have in general increased, apart from a minor cooler period in the early 1940's; since this date temperatures have regained the high level of the 1930's. Summer temperatures follow a broadly similar pattern, with colder periods about 1905–7, and a minimum during 1920–2; a slight maximum occurred about 1913. The main maximum occurred during the mid-1930's, with almost as warm temperatures during the mid-1940's, separated by a rather cooler period about 1940 and 1952. These figures are clearly related to the glacier variations, the glaciers advancing when winter precipitation is high and the spring and summer temperatures are relatively low. Thus the cool spell and heavy precipitation in the first decade of the century resulted in the glacier advance and maximum of 1909 and 1910. The relatively warm summer temperatures of the next decade helped to cause a slow retreat, which was followed by the advance of the 1920's, when both temperature values fell and precipitation reached a maximum. There is a lag between the lowest temperatures and precipitation maximum and the glacier advance; the former took place in the early years of the decade, while the glaciers reached their maxima at the end, about 1930. The large increase in temperature and fall in precipitation, taking place after this date, caused the very rapid retreat to start and it continued steadily until 1950 and longer in most glaciers. The photographs, Plate 1, taken at an interval of twenty years, show clearly the extent of the recent retreat of the snout of Austerdalsbre. The photographs were taken from the blocky moraine deposited in about 1909, one of the large blocks being shown in the foreground. It also shows the thinning of the glacier by the nature and lack of vegetation on the scree slope behind the rock wall of the valley. The latter feature forms part of the first rock bar described. During the early 1940's the cool temperatures balanced the low precipitation. Whether the retreat will be arrested in the larger glaciers, as it has been temporarily in some of the shorter ones, remains to be seen.

Characteristics of the valley walls.—The rapid terminal retreat of Austerdalsbre has been accompanied by a considerable thinning of the glacier by down-wasting. This is clearly shown by the trim-line, which is shown at the top of the scree on

Figure 2 above the eastern part of the glacier south of II. E (see Plate 1). Above this line the vegetation is much thicker and more luxuriant, with fairly large-size birch trees growing. In this part of the glacier the trim-line is about 400 feet above the present ice surface; from the two photographs it can be seen that most of this change has taken place in twenty years. Faint terracing on this slope, which is mainly scree deposits, indicates various stages in the shrinking of the glacier. On the west side of the glacier snout the thinning of the ice has exposed the rock slabs of the bar which crosses the valley near the present snout. These slabs are very smooth and in places show striations. At least two phases of erosion are indicated by the form of the rock slabs. The earlier erosion surface, often stained by weathering, is frequently abruptly truncated by a new surface of fresh erosion. The two faces often intersect at low angles. Movement of the ice over its bed is also shown by the tracks left by boulders, which have been pushed through finer material when in contact with the base of the glacier. Small lateral moraine ridges are found on the up-stream side of the rock bar on the west side of the glacier between I. W and Baird I and R (Fig. 2). These ridges are usually less than 5 feet high, and are quite bare of vegetation for a distance of about 100 feet above the ice. They show the gradual thinning of the ice and the steep glacier-side of the ridge probably formed as an ice-contact slope.

Further up-valley the walls of the trough become almost vertical, extending in a few places straight from the ice. In other places narrow bands of very loose and unstable scree and moraine lie along the edge of the ice, separating it from the rock walls. The walls are mostly smoothed and striated by ice action, except where frost action has loosened pieces to form scree, or moraine has been deposited. They are truncated spurs, dividing small tributary valleys, in which corrie glaciers have developed; these drain to the main valley by waterfalls or gullies. The corries are in various stages of development. None of them have rock basins, but they are broadly rounded valley heads, whose backwalls are steep, but whose floors are at a lower gradient than the gullies connecting them to the main valley, above which they hang. Ice and snow from the plateau above avalanches down the furthest up-stream gully on the east side of the glacier to form the snow cone shown on the map near IV. E.

The nature of the rock wall shows that at the maximum glaciation the valley was probably completely full of ice, which would have had a thickness of several thousand feet. A very good example of the two major processes of glacial erosion, grinding and plucking, is visible on the south-east side of Thorsbre ice fall, near Thors Horn (see Fig. 2). The rapidly moving ice of the ice fall has smoothed and striated the up-valley side of the rock wall, but where the ice leaves the over-hanging rock walls, the sharp angles point to the effectiveness of frost action in causing plucking of the rocks.

Non-glacial modifications.—Different processes are at work in various parts of the valley modifying the forms directly due to glacial erosion and deposition. In the upper valley, scree formation is the major process below the steep rock walls. Many of the tributary valleys entering the main stream have built alluvial fans, which are better developed lower down-stream, particularly below the glacier snout (see Plate 2). Some of these are shown on the map (Fig. 2). They result from attempts by the streams to establish the graded curve of water erosion on the over-steepened sides of a glacial trough.

Another process which is apparently responsible for a considerable amount of erosion of the valley walls is the snow avalanching which occurs in spring and

forms large snow patches on the valley sides, particularly below the gullies. Many of these avalanche fans, below the glacier snout, contain very large amounts of fine dirt and soil, with many tree roots and branches, as well as boulders. The latter come down with such force that they are shattered on impact with the boulders in the valley bottom, which may themselves be cracked. Avalanching is a process which is probably more important than is sometimes considered in the modification of a steep-walled valley of this type, with flat plateau-like summits, on which the winter snow can accumulate.

In the valley bottom itself the glacially eroded form is modified through the deposition of material by the meltwater streams, which come from the glacier very heavily laden with fine silt in suspension, as well as a considerable bed load of coarser material and boulders. This deposition has partially filled in the rock basins up-stream of the bars, which themselves have been cut through by the

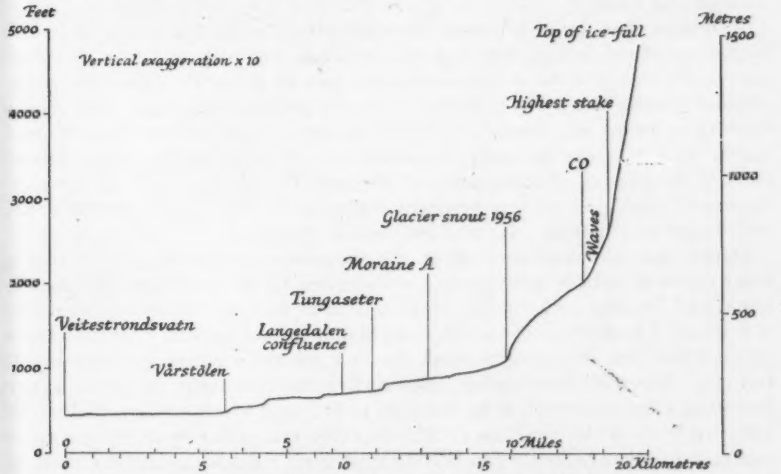


Fig. 5. Longitudinal profile of the valley and glacier

vigorous melt streams to form impressive gorges and rapids. The gradient of the valley, determined from the levelled profile, and shown in Figure 5, shows that the overall gradient of the stream between Veitestrondsvatn and the glacier snout, a distance of nearly 10 miles, is 66 feet/mile. This gradient may be compared to that of the valley train of Morsadalur in Iceland, in a somewhat similar situation, which is 32 feet/mile, and to the large sandur of Skeiðararjökull which is 27 feet/mile, or the Waimakariri River in the Southern Alps foot-hills and on the Canterbury Plains of New Zealand, which is on the average 26 feet/mile. All these rivers are heavily loaded and have braided channels like that draining Austerdalsbre and have considerably steeper gradients than the average English rivers, except near the sources of the latter. The steep gradient of the stream in Austerdal can be explained probably by the very large pre-glacial uplift of the area, which caused deep incision by fast flowing streams. Compared with the gradient of the glacier itself, shown on Figure 5, however, this slope is not steep. The profile surveyed up the first mile of the glacier has a gradient of 670 feet/mile, while the overall gradient between the snout and CO, a horizontal distance of 8900 feet, is 540 feet/mile. If the gradient

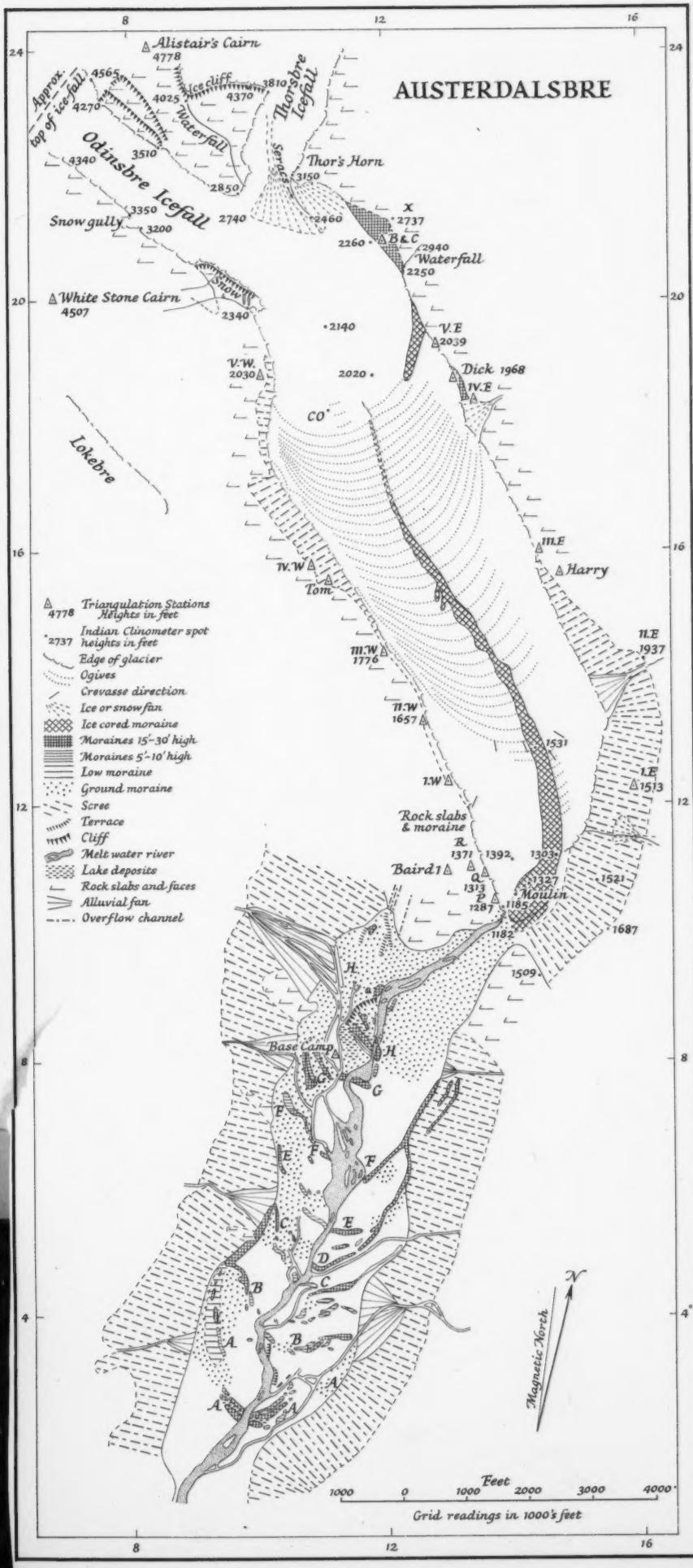
immediately below the snout continued above it, the thickness of the ice 1 mile up-stream would be about 500 feet. It is more likely, however, that the gradient of the valley floor increases up-glacier. It has been shown by boring that the ice is at least 400 feet thick in the centre of the valley near the snow cone.

There is considerable variation in gradient in different parts of the valley below the snout, with a gradual flattening of the slope down-stream as shown in Figure 5. The upper part of the profile from the glacier to the moraine F is relatively very steep; the gradient here is 164 feet/mile. Soon after leaving the glacier the stream becomes braided, which is characteristic of meltwater streams. This occurs because the stream, despite the steep gradient, is overloaded; aggradation takes place as a result and braiding occurs. When the meltwater is confined between steep valley walls the flat gravel filling is known as a "valley train" to distinguish it from the broader expanse of an outwash plain or sandur, which is not contained between walls of solid rock.

It appears that the melt stream from the glacier snout has slowly shifted in position as the rock step, which slopes eastwards, has been laid bare by down-wasting and retreat of the ice. As this step on the west side of the valley has become exposed, a series of terraces has been left by the gradual movement of the stream channels eastward and downward to their present position not far from the rock wall on the east side of the valley. Overflow channels, shown on the map, represent parts of the courses of the streams, which have flowed over and built up these terraces. Three levels above the present stream can be seen, which prevent a very wide lateral spread of the river near the snout of the glacier.

Having crossed moraines G and H, the stream spreads out over a wide area in many channels, until it again becomes concentrated where it cuts through moraines E and D. The gradient becomes rather lower until the rock bar above Tungaseter is reached. The gradient of the whole section of the stream above the rock bar is 110 feet/mile but in cutting through the rock bar the gradient increases to 221 feet/mile. Below this steep section, resulting from the valley step, the gradient again flattens in a braided stretch to 55 feet/mile, to the point where the Langedal stream joins that in Austerdal (see Plate 2). Shortly below the confluence the second minor rock step gives rise to further rapids and a small gorge. Below this another basin has been partially filled, giving a lower gradient of 27 feet/mile. The river then falls over the next major step above Vårstölen, in a series of rapids and gorges, for 163 feet vertically, with a gradient of 148 feet/mile. Below this the stream bed again flattens to 28 feet/mile at first and near the lake to $8\frac{1}{2}$ feet/mile. The lowest part of the course is over the deltaic deposits filling the head of the lake basin, which account for the low gradient in this section. The bed load has now become considerably finer and mud is deposited at the head of the lake.

Acknowledgements.—The work carried out on Austerdalsbre and the surrounding area has been made possible by grants from the Royal Society, the Royal Geographical Society, the Mount Everest Foundation, the University and several Colleges at Cambridge, Bristol University and many other sources. Help has been given by a large number of people. This paper is based on the work done by many parties; in particular by A. Young on the moraine survey, and by P. J. Walker on the moraine dating, also by R. F. Tomlinson and a party from Nottingham University on the lake sounding and profile levelling. The echo-sounding was carried out with equipment kindly loaned by Messrs. Kelvin and Hughes. The climatological data were obtained by R. F. Tomlinson from the Meteorological Institute of


AUSTERDALSBRE
Alistair's Cairn
4778
Approx top of ice-fall
Ice cliff
Waterfall
Odinsbre Icefall
Thorsbre Icefall
Serac
Thor's Horn
3150
Snow gully
White Stone Cairn
4507
Snow
Lokebre
B & C
Waterfall
V.E
2039
Dick 1968
IV.E
V.W.
2030
CO
IV.W
Tom
III.E
Harry
II.E
1937
III.W
1776
II.W
1657
1531
I.W
I.E
1513
Rock slabs & moraine
Baird
1371
1392
1303
1327
1313
Moulin
1287
1185
1182
1687
1509
1521
Base Camp
Triangulation Stations Heights in feet
Indian Clinometer spot heights in feet
Edge of glacier
Ogives
Crevasse direction
Ice or snow fan
Ice cored moraine
Moraines 15'-30' high
Moraines 5'-10' high
Low moraine
Ground moraine
Scree
Terrace
Cliff
Melt water river
Lake deposits
Rock slabs and faces
Alluvial fan
Overflow channel
Magnetic North
Feet
1000 0 1000 2000 3000 4000
Grid readings in 1000's feet

Norway. The recent figures on the movement of glacier snouts were supplied by O. Liestøl. The map, Figure 2, is also the result of the work of many people. Assistance from all sources and permission to use unpublished data are gratefully acknowledged. Both W. H. Ward, who led the parties in 1957 and 1958, and Dr. J. F. Nye have read this paper and made many helpful suggestions, for which I am grateful.

REFERENCES

[1] Glen, J. W., "Measurement of the deformation of ice in a tunnel at the foot of the ice-fall," *J. Glaciol.*, **2**, 20 (1956), pp. 735–45.

[2] Bull, C., and J. R. Hardy, "The determination of the thickness of a glacier from measurements of the value of gravity," *J. Glaciol.*, **2**, 20 (1956), pp. 755–62.

[3] de Boer, G., "The bending of blue bands beneath heavy boulders," *J. Glaciol.*, **3**, 21 (1957), pp. 31–3.

[4] Glen, J. W., "Measurement of the slip of a glacier past its side wall," *J. Glaciol.*, **3**, 23 (1958), pp. 188–93.

[5] Nye, J. F., "A theory of wave formation in glaciers," *Gen. Ass. int. Un. Geod., Chamonix* (1958), pp. 139–54.

[6] Members of the Cambridge Austerdalsbre Expedition: "Glaciological studies on Austerdalsbreen, Norway, 1955–57," *Gen. Ass. int. Un. Geod., Toronto*, **4** (1957), pp. 397–402.

[7] Ward, W. H., "Surface markers for ice movement surveys," *Gen. Ass. int. Un. Geod., Chamonix* (1958), pp. 105–10.

[8] Nye, J. F., "The deformation of a glacier below an ice fall," *J. Glaciol.*, **3**, 25 (1959) pp. 387–408.

[9] Nye, J. F., "A method of determining the strain rate tensor at the surface of a glacier," *J. Glaciol.*, **3**, 25 (1959), pp. 409–19.

[10] Cotton, C. A., 'Climatic accidents,' Christchurch, N.Z., 1942.

[11] Nye, J. F., "The mechanics of glacier flow," *J. Glaciol.*, **2**, 12 (1952), pp. 82–93.

[12] Strøm, K. M., "The geomorphology of Norway," *Geogr. J.*, **112** (1948), pp. 19–28.

[13] Faegri, K., "On the variation of western Norwegian glaciers during the last 200 years," *Gen. Ass. int. Un. Geod., Oslo*, **2** (1948), pp. 293–303.

THE GLACIERS OF MOUNT BAKER, RUWENZORI

JOHN B. WHITTOW

ALTHOUGH THE RUWENZORI high peaks and the major valleys have been accurately surveyed during the last decade, the detailed topography of the range is still not completely understood. Anyone who has experienced the thick forests and almost perpetual mists of Ruwenzori will appreciate why this is so.

During the initial planning of the International Geophysical Year, the coordinating committee for glaciology expressed their wish that every effort be made to accumulate data on all possible ice masses throughout the world. Thus it came about that a small party of geographers and a geologist from Makerere College, the University College of East Africa, were able to organize a number of short expeditions to the mountain. The first of these took place from December 1957 to January 1958 and was mainly in the form of a reconnaissance.[1] It was planned that the second expedition should be on the mountain for three weeks in June 1958 but, owing to the tragic death of W. H. G. Dickins (see *Geogr. J.*, **124** (1958), pp. 585–6), this visit was limited to a period of two weeks.

The major objects of the glaciological programme on the second expedition were twofold. One party aimed to work on the moraines of the Bujuku valley and afterwards on the Elena and Speke glaciers, the former of these glaciers having been marked by the January reconnaissance of 1958. The author and the late W. H. G. Dickins had as their first objective an examination of the glaciers on the southern slopes of Mount Baker. Although no detailed survey work was planned, it was hoped that some rudimentary mapping, together with photographs of the more critical features, would not only determine the number and configuration of the glaciers but would also establish a basis for future detailed observations and measurement. After completing investigations on Mount Baker, it was planned that Dickins and the author should rejoin the main party to aid in the work on the Elena and Speke glaciers.

Ever since the glaciers of Mount Baker were first photographed by the Duke of the Abruzzi in 1906, there appears to have been a great deal of uncertainty about their number and position. The almost constant cloudiness of Mount Baker, as exemplified by the 1955 aerial photographs,[2] makes it difficult to establish the true configuration of the ice on this particular mountain without actually studying it in the field. The expedition of June 1958 was fortunate in the clear weather which occurred during the visit to the southern glaciers of Mount Baker, so that it was possible to take a number of photographs and complete a sketch map of the glaciers.

A comparison of the map based on the Duke of the Abruzzi's observations in 1906 (Fig. 1*a*) with the D.O.S. 1 : 50,000 map of 1958 (Fig. 1*b*) makes it clear that there are several discrepancies in the size and configuration of the ice masses on

[1] (*a*) Report of the Makerere College Ruwenzori Reconnaissance, Dec. 1957 to Jan. 1958. Distributed through the Department of Geography, Makerere College, Kampala, Uganda. (Cyclostyled.)

(*b*) A brief record of the reconnaissance also appeared in *Ice* (News Bulletin of the British Glaciological Society), No. 2, July 1958. p. 2.

[2] Hunting Aerosurveys, Ltd., June and October 1955.

Mount Baker, not all of which can have been the result of glacial recession during the fifty-two year period. Thus the first objective in June 1958 was to determine which, if any, of the glaciers had disappeared since 1906, and also to estimate the present shape and position of all the existing ice masses (Fig. 1c). As a secondary objective, it was aimed to make a more detailed examination of one particular

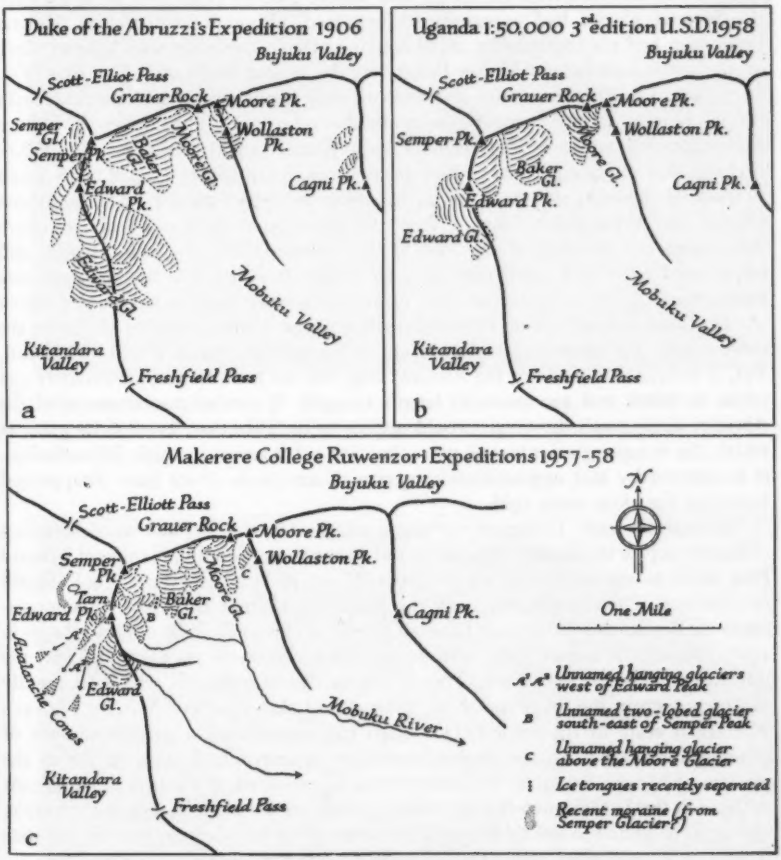


Fig 1. The glaciers of Mount Baker

glacier. Because of its accessibility the Moore glacier was chosen for this closer investigation.

The Duke of the Abruzzi's 1906 map names four glaciers on Mount Baker; the Edward, Baker, Semper, and Moore, although the latter was always referred to by him as the "Mobuku glacier" in the official report of the expedition.[1] His map also indicates two large unnamed ice masses, one occupying the summit ridge of Moore

[1] De Filippi, F., 'Ruwenzori, an account of the expedition of H.R.H. Prince Luigi Amedeo of Savoy,' London, 1908.

and Wollaston Peaks, the other immediately west of Edward Peak, in addition to depicting at least three lobes of the Edward glacier. Of lesser importance were two sizable ice or snow patches, north of Cagni Peak, both of which had been mapped and photographed in 1906. (Plate between pp. 152–3, De Filippi, 1908.)

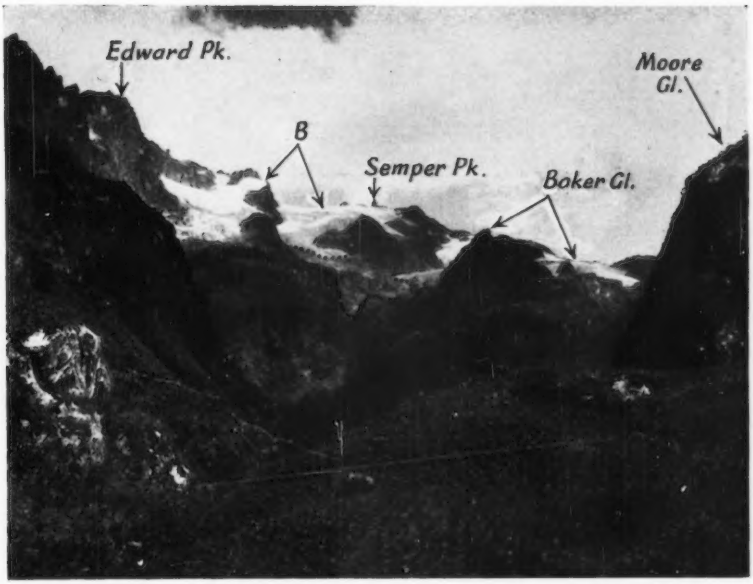
The D.O.S. 1 : 50,000 map, 1958,[1] which is the first reliable map of the Ruwenzori, names only the Edward, Baker and Moore glaciers (Fig. 1*b*). Thus by 1958 the Semper glacier had apparently disappeared, although in 1906 the Abruzzi expedition had photographed a small hanging glacier, complete with bergschrund, on the north-west face of Mount Baker, low down near the Scott-Elliot pass (Fig. on p. 153, De Filippi, 1908)[2] and one can only assume that this coincided with the ice marked as the Semper glacier on the 1906 map. The Makerere College Ruwenzori Reconnaissance (December 1957–January 1958) confirmed the D.O.S. findings that the Semper glacier had disappeared, leaving only a small snow patch to mark its original position. Beneath the site of the former glacier, on the southern side of the Scott-Elliot ridge, a large freshly-formed moraine, still free from vegetation, can be seen at the foot of the western cliffs of Mount Baker, and impounded by it is a small tarn with no outlet. It is possible that this moraine marks the limit of the avalanched ice, or even of a small regenerated glacier, which would almost certainly result from the melting of the Semper hanging glacier on the cliffs above. To assess the original extent of the Semper glacier would be difficult, but, if reference is made to the Abruzzi map, the ice measured approximately 450 yards in width and 200 yards in length in 1906. A careful measurement of the Abruzzi photograph, however, would appear to indicate that, even at its greatest width, the Semper glacier was no more than 375 yards across in 1906. Nevertheless, it is noteworthy that approximately 75,000 square yards of ice have disappeared from this site alone since 1906.

The narrow and Y-shaped ice mass which Abruzzi depicts as descending obliquely across the western face of Mount Baker from the summit ridge of Edward Peak down to approximately 14,500 feet (Fig. on p. 153, De Filippi, 1908) is still in existence. Photographs taken by the Makerere College Ruwenzori Reconnaissance show that this prominent hanging glacier is almost as large in area now as in 1906, although it seems fairly certain, by a comparison of photographs, that the thickness of ice has decreased. This is one of the two glaciers which frequently avalanche across the track north of Kitandara Lakes (glaciers A^1, A^2; Fig. 1*c*). The small scale of the 1958 D.O.S. map has necessitated a certain amount of generalization which in the majority of cases is unavoidable but, so far as the glaciers of Mount Baker are concerned, this has resulted in the loss of significant detail. On the D.O.S. map the two small glaciers on the western face, for example, appear to be joined to the Edward glacier, although in fact they are entirely separate from it; a feature which was clearly marked on Abruzzi's map.

The Edward glacier is one of the most ill-defined of the Mount Baker glaciers. The 1906 Abruzzi map shows the Edward glacier to extend on both the western and eastern sides of the main ridge which runs southwards from Edward Peak to the Freshfield Pass. The impression given is that the name "Edward glacier" refers to an ice cap straddling the ridge and pushing out several lobes towards the Mobuku valley and the Kitandara valley. If anything, the 1906 map would seem to imply that the main meltwater stream from the Edward glacier drains eastwards into the

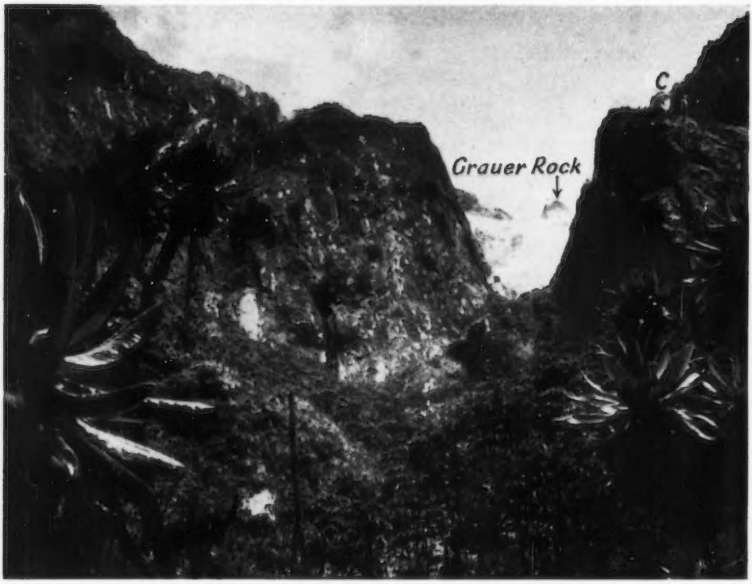
[1] Directorate of Overseas Survey, 1958, 1 : 50,000 map. Series Y732. Sheet 65/11.

[2] An enlargement of the same photograph appears between pp. 142–3 in the *Geogr. J.*, 29 (1907).



The southern glaciers of Mount Baker from the upper Mobuku valley. B = unnamed two-lobed glacier (see Fig. 1c); ···· present glacier fronts; ---- possible 1900 front

Large roche moutonnée (approx. 13,700 feet) below the Moore glacier, Mount Baker



The Moore glacier, Mount Baker: above: seen from about 13,000 feet in the upper Mobuku valley; below: from the roche moutonnée, at about 13,700 feet. C = unnamed (see Fig. 1c)

Mobuku valley. It is difficult to reconcile the photographs taken by the Abruzzi expedition (*e.g.* Plate between pp. 152–3, De Filippi, 1908) with their map, so far as the ice on the Mobuku side of the ridge is concerned. From the 1906 photographs it is only possible to establish with certainty that, at this date, the summit ridge ice cap extended a short distance on the eastern side of the ridge. In June 1958 a tiny remnant of this was still in existence. High on the western side of the ridge, however, a wide, heavily crevassed glacier was photographed in June 1958 and there appears little doubt that this glacier, which falls steeply south-westwards towards Kitandara Lakes, is the true Edward glacier (Fig. 1*c*). The 1958 D.O.S. map names the Edward glacier, but owing to the small scale the direction of ice-flow is not absolutely clear. It is noteworthy, nevertheless, that this 1958 map shows no ice on the eastern side of the ridge which could possibly correspond to the extensive ice lobes which Abruzzi depicted as being part of the Edward glacier. Thus it would seem that the inclusion of these pronounced eastward-flowing ice lobes as part of the Edward glacier complex on the 1906 map was the result of a misinterpretation of the panoramic photograph taken in 1906 from the Stairs Peak of Mount Luigi di Savoia (Plate between pp. 152–3, De Filippi, 1908). From the latter viewpoint, the upper part of the large two-lobed glacier which flows south-eastwards from Semper Peak (Glacier B, Fig. 1*c*) appears to be joined to the ice cap which straddles the ridge south of Edward Peak. In fact "Glacier B" is entirely separate from the latter, the two being divided by precipitous cliffs which are invisible from Stairs Peak. An examination of these two ice masses in June 1958 pointed to the probability that they had always been separate entities. Considering the difficult weather conditions under which the Duke of the Abruzzi worked, and the fact that his was the first systematic attempt to map the Ruwenzori high peaks, mistakes such as this and the one noted by Busk on the Mount Stanley glaciers[1] are perfectly understandable.

The alternative suggestion would be to regard the eastward-flowing ice lobes of the 1906 Edward glacier complex as having melted during the last fifty years. The author thinks that this is unlikely since there is no evidence in the field which would suggest a very recent retreat of such great magnitude. Investigations in June 1958 suggested, however, that the unnamed two-lobed glacier (Glacier B) has only recently become separated from the Baker glacier (Fig. 1*c*). Photographs taken at this date show how the bare rock which now divides the two glaciers is a light-grey in colour, indicating that recolonization by mosses and lichens has not yet been completed. A somewhat indistinct photograph taken by Moore in 1900 suggests that the two glacier tongues were joined at that date,[2] and it is possible that they were still joined in 1906. It seems probable that the two-lobed glacier (Glacier B) will itself split into two separate glaciers in the near future.

The true position of the Baker glacier and the Moore glacier is fairly accurately portrayed by the 1906 map, although it is important to note that there has been a quite considerable shrinkage of both these glaciers during the last half-century. The Abruzzi photographs show that the Moore and Baker glaciers were then served by the same névé field, whereas they are now self-contained features. Furthermore, a comparison between the 1906 photographs and those taken in 1958 indicates that in its middle course the Moore glacier is now only about half as wide as it was in 1906.

[1] Busk, D., "The southern glaciers of the Stanley group of the Ruwenzori," *Geogr. J.*, **120** (1954), 137–45.

[2] Moore, J. E. S., 'To the mountains of the moon,' London, 1901. Plate opposite p. 246.

The prominent hanging glacier which descends westwards from the col between Moore and Wollaston Peaks is well shown in the 1906 photographs (Fig. on p. 147, and Plate between pp. 152–3, De Filippi, 1908), although there is a discrepancy in the amount of ice depicted on the Abruzzi map and that portrayed in his photographs. The latter clearly show that the glacier descends steeply towards the Moore glacier, not southwards along the ridge beyond Wollaston Peak as the map claims. In 1958 this unnamed glacier was still in existence (Glacier C, Fig. 1*c*), although it is not included on the 1958 D.O.S. map. It is almost impossible to view the full extent of this glacier except from the summit ridge of Mount Baker. Thus it is interesting to speculate whether the Duke of the Abruzzi was aware of its existence before climbing to the summit of Mount Baker. It is probable that he was not, for his route up the rocks to the east of the Moore glacier was directly beneath the snout of the hanging glacier and therefore hazardous in the extreme.

Finally, the last change in the distribution of the Mount Baker ice since 1906 concerns the two large ice or snow patches north of Cagni Peak which had been photographed and mapped by the 1906 expedition. These cannot be distinguished on aerial photographs and they were not seen during the expedition in June 1958.

Thus the first objective of the 1958 investigations, namely the construction of a sketch map to show the present distribution and configuration of the glaciers on Mount Baker, had been completed. Apart from the new interpretation of the Edward glacier complex, a comparison between the 1906 map (Fig. 1*a*) and the 1958 sketch-map (Fig. 1*c*) serves to illustrate the considerable glacial recession which has taken place during the last half-century.

In an attempt to obtain more specific information on the rates of glacier recession, it had been planned to select one of the southern glaciers of Mount Baker for more detailed observations. Since the Moore glacier appeared to be a self-contained valley glacier and was also the most accessible, the choice was not difficult.

Between Bujongolo rock-shelter (approx. 12,400 feet) and the Moore glacier, the upper Mobuku valley consists first of a bog almost a mile in length, beyond which, at approximately 13,000 feet, is a valley step. On the slope above this step (second valley step, Fig. 2) an old moraine covers the valley-floor at an altitude of approximately 13,250 feet. It consists of large blocks of rock thickly moss-covered and overgrown with *senecio* (giant groundsel) and *lobelia*, the former usually growing to more than five feet in height. This moraine may be correlated with one of the group of prominent recessional moraines which stand at an elevation of 13,750 feet below the Elena glacier of Mount Stanley[1] and possibly with the moraine at 13,600 feet below the Speke glacier.[2] Bergström believes that the Elena glacier moraines in question cannot be definitely dated, but by comparison with similar investigations on the Scandinavian glaciers he suggests that they are later in date than the major Swedish ice advances of 1740 and 1800. The presence of *senecio* over five feet in height on the Moore glacier moraine at 13,250 feet implies, however, that the latter may be more than 150 years old, since it has been calculated that a *senecio* grows approximately one metre in height every hundred years.[3] It is open to question whether this calculation can be applied to all the types of *senecio* found on Ruwenzori, or whether one can regard the growth rates on the western and eastern slopes of the mountain as comparable, but it is of interest in so far as it suggests a

[1] Bergström, E., "The British Ruwenzori Expedition, 1952. Glaciological observations—preliminary report," *J. Glaciol.*, **2** (1955), pp. 469–76.

[2] Second Report of the Makerere College Ruwenzori Expedition, June 1958, p. 14.

[3] Hauman, L., "Les *senecio* arborescents du Congo," *Rev. Zool. Bot. afr.*, **28**, fasc. 1 (1935).

possible means of dating some of the moraines. The ultimate dating of the Moore glacier moraine may show that it was formed contemporaneously with the innermost of the large moraines below the west Stanley glacier.[1] De Heinzelin regards the latter as marking the line of a prolonged still-stand of the ice several centuries ago. Following a subsequent retreat, however, he believes that the ice re-advanced at some time near the middle of the nineteenth century as far as the inner margin of the moraine in question before retreating rapidly to its present position. Such an explanation would allow the Moore glacier moraine at 13,250 feet to be correlated more easily with the innermost of the large west Stanley moraines which in turn might be regarded as equivalent in age to a component part of the Elena group of moraines without necessarily invalidating Bergström's tentative dating. Judging by the author's observations near the Speke glacier snout on Ruwenzori, it would be quite possible for *senecio* once established on the old moraine of the Moore

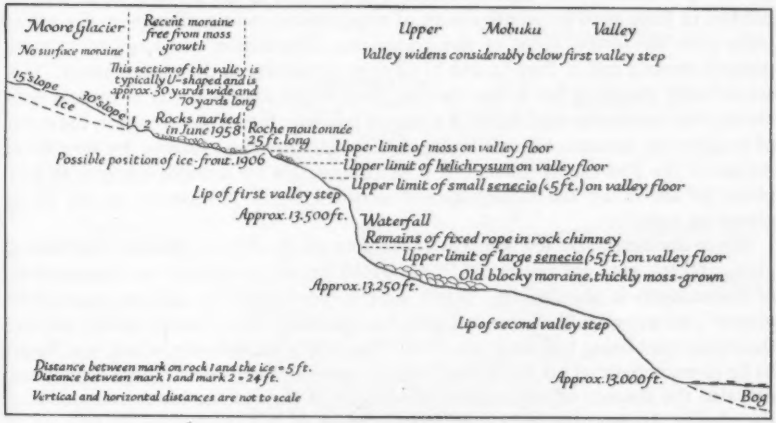

Moore Glacier
No surface moraine
Recent moraine free from moss growth
Upper Mobuku Valley
Valley widens considerably below first valley step
This section of the valley is typically U-shaped and is approx. 50 yards wide and 70 yards long
15° slope
30° slope
Ice
1
2
Rocks marked in June 1958
Roche moutonnée 25 ft. long
Upper limit of moss on valley floor
Possible position of ice-front 1906
Upper limit of helichrysum on valley floor
Upper limit of small senecio (.5 ft.) on valley floor
Lip of first valley step
Approx. 13,500 ft.
Waterfall
Remains of fixed rope in rock chimney
Upper limit of large senecio (5 ft.) on valley floor
Old blocky moraine, thickly moss-grown
Approx. 13,250 ft.
Lip of second valley step
Distance between mark on rock 1 and the ice = 5 ft.
Distance between mark 1 and mark 2 = 24 ft.
Vertical and horizontal distances are not to scale
Approx. 13,000 ft.
Bog

Fig. 2. Section of the Upper Mobuku Valley, Ruwenzori, June 1958

glacier to continue growing despite the close proximity of the ice during a subsequent re-advance.

Slightly higher than the old moraine, the Mobuku stream plunges over another valley step at approximately 13,500 feet, and it is at this point that the steep valley walls close in, so making it difficult to reach the Moore glacier from below without first ascending a rock-chimney to the right of the waterfall. There seems little doubt that this is the chimney described by the Duke of the Abruzzi, for underneath the chockstone at the top of the climb the remains of two fixed ropes were discovered in June 1958. Both were decayed and rotten with age and were covered with lichens. One was a thick hemp rope ($\frac{3}{4}$ inch diameter) and the other a hemp line ($\frac{3}{8}$ inch diameter), both of a style rarely used today. Since the walls of the chimney now have a thick covering of undisturbed moss, it seems unlikely that this route to the glacier has been followed for a considerable length of time. Thus it is possible that the ropes are remnants of those which were placed there by Grauer and Abruzzi himself at different times in 1906 (p. 145, De Filippi, 1908).

The top of the chimney opens out on to the lip of the first valley step and from

[1] De Heinzelin, J., 'Les stades de récession du glacier Stanley occidental,' Exploration du Parc National Albert, sér. 2, Fasc. 1, Brussels (1953).

this point to the glacier the gorge-like valley is never more than thirty yards in width. A prominent roche moutonnée (25 feet in length) stands not far above the lip of the valley step, and on the surrounding rocks there is numerous evidence of recent glacial erosion. From the roche moutonnée to the ice front, a distance of some 70–80 yards, the valley floor is strewn with fresh moraine, ranging from large blocks weighing several hundredweight to fine rock flour.

The Abruzzi expedition judged the height of the Moore glacier terminus to stand at 13,694 feet (*i.e.* 4175 metres) in 1906, but it did not prove possible to record the true height of the glacier snout in 1958. Although there has obviously been substantial retreat in recent years, it has been largely in the nature of a horizontal or slightly oblique retreat so that the elevation of the glacier snout may not be much higher than the 1906 figure. It seems fairly certain that, owing to its enclosed and sheltered position at the head of the Mobuku valley, the Moore glacier remains the lowest "permanent" ice on Ruwenzori. The position of the present ice front was marked in June 1958 by an alignment of conspicuous paint markings on the valley walls with the lowest point of the ice tongue. In addition two large rocks were marked (rocks 1 and 2, Figs. 2 and 3) in close proximity to the glacier snout. The second rock stands 24 feet below the first rock which itself is partly in contact with the ice; the reason for marking rock 2 was to facilitate future recordings in the event of a slight ice advance overwhelming rock 1. Despite the evidence for an overall retreat of the Ruwenzori glaciers, it is not impossible for a minor advance to take place, as shown by the measurements recorded by H. Osmaston on the Elena glacier in 1953.[1]

There are singularly few superficial features on the Moore glacier. Dirt cones, glacier tables, etc., are not in evidence, whilst the *niève pénitente* so characteristic of Kilimanjaro is absent here. When seen in June 1958 the glacier was a "dry glacier": no snow could be seen anywhere on the lower two-thirds of the ice surface, the upper part being hidden from view. The lack of snow cover, which was found to be characteristic of all the Ruwenzori ice masses visited on the June expedition, revealed the absence of any marked crevassing, at least in the lower two-thirds of the glacier. In fact, the only conspicuous break in the smooth ice surface was a deep irregular groove running for some distance down the centre of the glacier and terminating at the snout. At intervals the groove appeared to be punctuated by deep holes which bore every resemblance to glacier-mills. Thus, rather than regard the groove as a modified crevasse, it is more probable that it was cut by a surface melt-stream which has now gone beneath the ice. To support this theory is the fact that the main sub-glacial stream emerges from beneath the ice almost immediately below the groove. The ice cavern formed by this sub-glacial stream was found to extend back under the ice some 25 feet. The glacier was melting at a considerable rate near the snout and the ice was so wet that it defeated all attempts to produce a satisfactory rubbing of the ice-crystal structure.

A prominent fan-shaped surface veneer of rock flour near the right-hand side of the glacier front appears to have been formed by the ejection of morainic material on to the surface by an englacial stream which no longer exists. Otherwise there is a conspicuous lack of surface moraine on the Moore glacier in contrast to the relatively large amount of sub-glacial material that is present. In front of the glacier a profusion of moraine covers the valley floor, although it is possible to pick out a definite morainic ridge running down the centre of the valley parallel to the direction of ice-flow. The coarse nature of the material makes it unlikely that the latter

[1] Report of the Makerere College Ruwenzori Reconnaissance, Dec. 1957–Jan. 1958, p. 11.

feature is an esker, but there is a possibility that it is the remnant of a medial moraine. Nevertheless, its position with regard to the ice tongue, which extends down-valley from the otherwise straight glacier front, leads one to think that the feature is more likely to be the remains of a small recessional moraine which was formed during the original extension of the ice tongue (Fig. 3). It is noteworthy that the latter extends down-valley from the eastern side of the glacier, and observations have shown that owing to the steep valley walls this side of the glacier snout

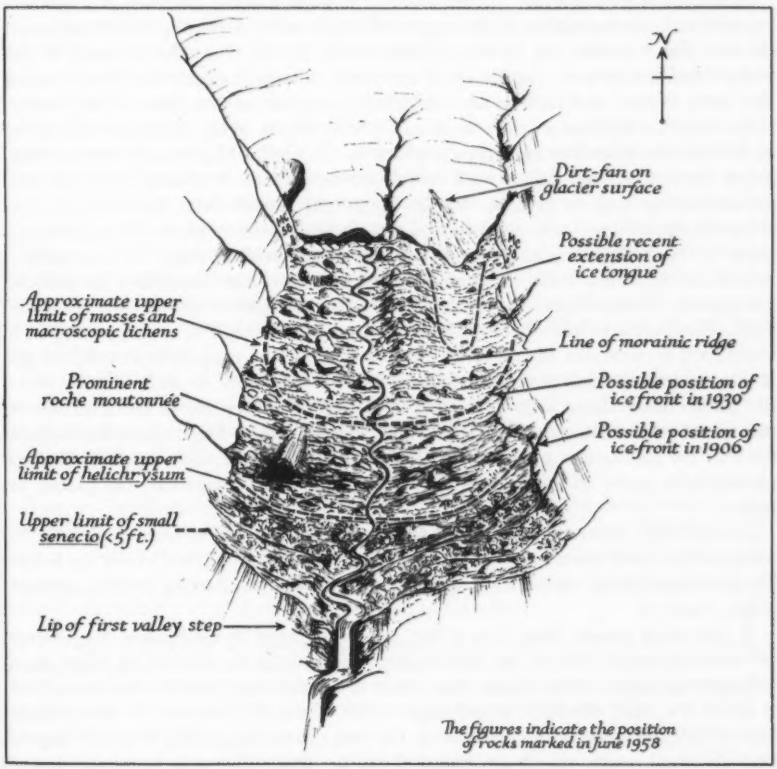

N
Dirt-fan on glacier surface
Possible recent extension of ice tongue
Approximate upper limit of mosses and macroscopic lichens
Line of morainic ridge
Prominent roche moutonnée
Possible position of ice front in 1930
Possible position of ice-front in 1906
Approximate upper limit of helichrysum
Upper limit of small senecio (<5 ft.)
Lip of first valley step
The figures indicate the position of rocks marked in June 1958

Fig. 3. The Moore Glacier, Ruwenzori, June 1598

remains in shadow until nearly midday. On the majority of days the Ruwenzori cloud builds up to sufficient proportions to blot out the sun by mid-morning, so that only the western side of the Moore glacier snout is subjected to direct insolation for a few hours during a number of mornings each year. Even on a fine day it has been calculated that the eastern side of the ice receives no more than five hours of direct insolation. A feature of similar significance is depicted by an early photograph[1] and a more recent map[2] which show an ice tongue extending down from the

[1] Humphreys, G. N., "New routes on Ruwenzori," *Geogr. J.*, **69** (1927), Plate opp. p. 521.

[2] Menzies, I. R., (*a*) "The glaciers of Ruwenzori," *Uganda J.*, **15** (1951), pp. 177–81.
(*b*) "Some observations on the glaciology of the Ruwenzori Range," *J. Glaciol.*, **1** (1951), pp. 511–12.

eastern side of the Speke glacier, the orientation of which is comparable to that of the Moore glacier. In this case the shadow of Johnston Peak extends across the ice. The strong suggestion that both these ice tongues have virtually disappeared in very recent years may point to a significant decrease in cloud amount, so that the entire glacier surface may now be receiving a more equal degree of insolation. It has been suggested elsewhere that there may have been a decrease in the Ruwenzori cloud amount during the last fifty years.[1]

A feature of considerable interest below the glacier is the evidence of a gradual vegetational recolonization of the upper Mobuku valley following the recession of the ice. For a distance of about 60 yards below the ice front the moraine on the valley floor is free from vegetation of any kind,[2] although nearer the lower end of this zone mosses and lichens are beginning to appear at the sides of the valley. When they are without a lichen or moss covering visible to the naked eye, the rocks of the moraine present a light-grey appearance. A similar shade can be seen on the lower portions of the valley walls which are at present in contact with the ice, demonstrating that in addition to the horizontal retreat there has been a considerable shrinkage in the thickness of the glacier in recent years. Measurements taken in 1958 slightly above the snout show that recolonization of macroscopic lichens on the valley walls commences at approximately 10 feet above the present ice surface. Thus, during the Duke of the Abruzzi's visit to the Moore glacier in 1906, the ice must have been at least 10 feet thicker than at present, and it is interesting to note that his party was forced to climb the rock walls in order to get above the terminal fall of seracs, whereas today it is possible to walk directly on to the glacier snout from below. Further evidence of a decrease in ice thickness is provided by the Abruzzi photographs of the Moore glacier. High up on the western flank of the glacier a large area of rock slabs is now visible, although the Abruzzi photographs prove without doubt that these rocks were covered by the glacier in 1906.

Down-valley from the vegetation-free zone, mosses are already beginning to colonize the valley floor some 60 yards from the glacier snout, whilst not far below the prominent roche moutonnée the first *helichrysum* (everlasting flower) appears (Figs. 2 and 3).

A few small *senecio* (less than 5 feet in height) have re-established themselves between the upper limit of the *helichrysum* zone and the lip of the first valley step, although the larger *senecio* (more than 5 feet in height) disappear on the valley floor at about the same elevation as the upper limit of the old moraine. If one accepts unreservedly Hauman's calculations on the rate of *senecio* growth, it would appear that the small *senecio* which are found above the first valley step range up to 150 years in age. This means that some of them must have been in existence at the time of Abruzzi's visit, making it impossible for the ice front to have stood at the lip of the first valley step in 1906. Therefore it is of interest to read the Duke's account of the Moore glacier in 1906, for he states that ". . . the Mobuku (Moore) glacier appears actually to overhang (the upper Mobuku valley), all broken and full of crevasses, covering the upper portion of the last rocky cliff and ending in an ice-cavern whence issues the torrent" (pp. 144–5, De Filippi, 1908). He goes on to describe the "terminal fall of seracs," so that his description would seem to imply

[1] Second Report of the Makerere College Ruwenzori Expedition, June 1958, p. 16.

[2] This zone is probably equivalent to the innermost uncolonized lichen zone noted by Bergström on Mount Stanley. He regarded the outer boundary of this zone as marking the position of the glacier fronts on Ruwenzori in about 1930. (Bergström, 1955, *op. cit.*)

that in 1906 the Moore glacier stretched down-valley as far as the steep slopes of the first valley step. It has been shown how the presence of the small *senecio* may give a lower limit to the position of the ice front at that date and one can only conclude, therefore, that in 1906 the ice front most probably stood on the upper slopes of the valley step nearer to the prominent roche moutonnée than to the lip of the first valley step (Fig. 2).

In June 1958 it was calculated that the Moore glacier terminated some 70–80 yards up-valley from the roche moutonnée. There are no longer any seracs because of the decrease in ice thickness and the fact that the angle of slope of this section of the valley floor is only about 15°. Consequently, taking into account the Abruzzi description and the calculations of Hauman, it is possible to suggest that the ice front retreated from a position near the roche moutonnée to its present position, a distance of over 80 yards, in about fifty years. If, as is suggested by Bergström's dating (see note 2, p. 378), the outer boundary of the vegetation-free zone immediately below the glacier snout can be regarded as the position of the ice front in 1930, then there must have been a retreat of some 60 yards since that time. The increased recession rate since 1930 agrees with the findings on other Ruwenzori glaciers,[1] with the exception of the Elena glacier, which has, however, been retreating up a steep gully. Despite its increased rate of recession since 1930, the Moore glacier appears to be receding at a slower rate than the Elena glacier, for Bergström has demonstrated that in the period 1930–52 the Elena glacier retreated about 100 metres (109 yards).

Measurements of the actual ice movement, stratigraphy and glacier budget, etc., were beyond the scope of the June expedition to the Moore glacier. It is hoped that the photographs, diagrams and descriptive notes will serve as a basis for more detailed examination in the future.[2]

Note.—The glaciological work of the second Makerere College expedition to the Ruwenzori was curtailed owing to the illness and subsequent death of W. H. G. Dickins. Before he was taken ill Mr. Dickins assisted the author in the preliminary examination of the Moore glacier, and the section of the paper which refers to the latter is due in no small measure to his help.

[1] For example, since 1930 there has been a retreat of about 270 yards recorded on the west Stanley glacier, with a considerable retreat since 1940. (De Heinzelin, 1953, *op. cit.*)

[2] The details recorded in the above paper have been accepted by the Directorate of Overseas Survey for incorporation in a forthcoming large-scale map of Ruwenzori.

THE MOVEMENT OF SHINGLE OVER THE SEA BED CLOSE INSHORE

C. KIDSON AND A. P. CARR

A RECENT PAPER in the *Journal*[1] described experiments, carried out early in 1957 in the Orfordness area of Suffolk, into the movements of beach material. These experiments employed an improved version of a technique of radioactive marking first used on shingle at Scolt Head Island, Norfolk, in 1956.[2, 3] The present paper describes further work carried out at Orfordness between 6 February and 13 April 1959, which employed essentially the same methods for marking and tracing as were used in 1957.

This new work was designed to extend and consolidate the information gained in the earlier experiments. Additional data on the extent to which material passed between the sea bed in the offshore zone and the beach were sought. It was hoped also to trace the precise manner in which material moved in and across the estuary of the River Ore. Plate 1 gives an aerial view of the experimental sites.

Choice of tracer and marking of pebbles.—In 1957, flint shingle was surface-coated with the radioactive isotope barium 140–lanthanum 140 which has a half-life of 12 days. It was possible to trace these pebbles for 6 to 8 weeks. The same surface-coating technique was used in the 1959 experiments. For work offshore, and away from the estuary of the River Ore, barium 140–lanthanum 140 was again employed because of its safe handling characteristics and its convenient half-life. For work on the shingle banks near the estuary, an isotope with a shorter half-life was required in order that repeated injections of radioactive material could be made at short intervals. For this purpose the isotope lanthanum 140, with a half-life of 40 hours, was chosen. Pebbles marked with this radioactive substance could be traced for about one week. An added advantage of using a shorter lived isotope in the estuary was that, if any radioactive pebbles reached Shingle Street, on the southern shore, the activity would be quickly dissipated.

All the shingle treated with radioactive isotopes for these experiments was part of a random sample of material from Orford Beach. In 1957 pebbles with a surface layer of ferric oxide were selected because it was found that adsorption of the radioactive tracer was greatest with these pebbles. Later work showed that satisfactory adsorption could be achieved without the ferric oxide layer and for the 1959 experiment no selection of pebbles of any kind took place.

At one stage in the experiments, on the shingle banks in the mouth of the River Ore, a long period of calm weather followed an injection of radioactive shingle. This resulted in the dissipation of the radioactivity before any movement could take place. To fill the gap in the sequence of experiments, pebbles marked with a type of marine paint, which had been used successfully elsewhere, were substituted. This incident underlined some of the weaknesses of the radioactive technique. It is not possible to make rapid adjustment to changed circumstances since isotopes are not necessarily freely and quickly available. In any event, the extra cost involved in acquiring additional radioactive material is by no means negligible.

Instrumentation and tracing.—Tracing under water was carried out by searching the sea bed with geiger counters mounted on a heavy metal sledge and connected by a multicore cable to a 1368 field ratemeter in the towing launch. On the beaches and shingle banks, a scintillation counter mounted on a light sledge and towed by hand was employed for tracing. This was connected to a 1320 field ratemeter carried by the operator, the 1368 field ratemeter is a transistor model which has superseded the 1292 type used in 1957. There were other differences of some importance in

the methods of tracing compared to earlier experiments. The scintillation counter was enclosed in a waterproof brass cylinder and this meant that it could be submerged in water. This was of great value in searching the shingle banks since much larger areas could be quickly swept. Trials with newer types of scintillation counter sledge than were used in 1957 led to the adoption of an alloy sledge of very simple design, but which had exceptional towing qualities. This reduced the fatigue of operation considerably. A second scintillation counter, which could be carried rather than towed, was also used (Plate 4). Plate 2 shows underwater detecting equipment.

Control and plotting.—A series of permanent shore traverse stations, established for the research programme of the Nature Conservancy's Coastal Unit, along the length of Orford Beach, was used for control and plotting. The points of injection of the radioactive shingle, selected in the light of earlier experience, were fixed by sextant in relation to these shore stations. In addition, the points of injection were located by theodolite intersection from the shore. In tracing the movement of the radioactive material, the positions of contacts were fixed by sextant, using the shore stations, each of which was marked by an aluminium alloy beacon, 14 feet in height.

Weather records and wave data.—Throughout the period of the experiments records were kept of wind and wave conditions. Wind strength and direction were recorded using a hand anemometer, and wave period, height and direction were estimated. Wind direction and speed compared so closely with those recorded at the meteorological station at Felixstowe that it proved possible to accept these much fuller records as holding good for the experimental site. A summary of the winds of comparatively high velocity is given in Table I.

TABLE I

Days on which wind strength exceeded 15 *knots* (*i.e. Force* 5 *or greater*) *between* 6 *February* 1959 *and* 13 *April* 1959

Date	*Wind speed (in knots)*	*Wind direction (in degrees from true N.)*
Feb. 20	20	250
March 3	17	150
4	17–20	170–220
5	16–23	160–190
6	17	180
7	17	190
8	16	030–040
9	20	060
10	16	100–110
11	16	170
16	17–19	360–030
17	19–22	040–050
18	16–20	050–060
19	18	040
24	17	090
27	17	150
28	17	230
29	20	140
30	16	210
April 6	17–25	220–260
7	20–24	260–270
8	18–23	200–240
11	17	160

During February the weather was largely anticyclonic. Wind speeds were very low and wave heights rarely exceeded one foot. Although wind strengths were greater in the latter part of the month, 15 knots was exceeded on only one day. Wave heights remained low, however, since the increase in wind strength was accompanied by a change in direction to south-westerly; that is, they blew offshore.

During March, winds were generally stronger and 15 knots was exceeded on 19 days. On 10 of these days winds were onshore. This resulted in breakers estimated at 4 feet on several occasions and once between 5 and 6 feet. Waves, beyond the breaker zone, with a height of over three feet were recorded on a number of occasions.

In early April wind strengths exceeded 15 knots on four days. On April 8 gusts of 40 knots were measured by hand anemometer several times. The maximum speed recorded, in a gust, was 42 knots. These very strong winds were all from an offshore direction, generally south-west, and wave heights were comparatively small, not exceeding 2 feet 6 inches.

Tides and currents.—Published information on the strength and direction of tidal streams and currents in the experimental area is limited. The Atlas of Tides[4] shows that at springs, on the flood, the tidal stream sets southward, parallel to the shore, with a maximum flow of 2·5 knots. On the ebb, the tidal stream sets in the opposite direction with a maximum flow of 2·9 knots. A series of current readings with a Watts current meter was taken during the period of the experiment. These gave close agreement in the inshore area with the tidal stream data. The ebb, northward, was always slightly higher in strength than the flood southward. Bottom currents were found to be about two-thirds the value of the surface speeds. Close to the entrance to the Ore estuary, eddies produced surface drift which could run counter to the tidal stream. This was observed repeatedly at the most southerly of the "offshore" experimental sites.

In the entrance to the river, current data is even more limited. The most recent large scale Admiralty Chart[5] of the River Ore and its approaches gives a figure, at springs, of 6 knots on the ebb and 4 knots on the flood, through the narrows between North Weir Point and Shingle Street. While the configuration of the entrance has changed considerably since 1897, when the chart was published, the figures are probably still a fair indication of conditions. The difficulties of taking current readings, with modest equipment, in water flow of this order, are obvious. A limited number of both top and bottom readings were taken. These indicated that values at full flood and ebb are similar to those quoted. About a half mile inside the river readings of 3 knots, on the flood, and 4 knots, on the ebb, accorded with the Admiralty Chart records.

Bottom currents, while varying widely, were again roughly two-thirds the speed of the surface currents. With the available equipment no indication of the direction of bottom currents could be obtained. For a really satisfactory picture of the water circulation, in the entrance to the River Ore, and particularly over the shingle banks, a much more detailed series of readings is necessary than it was found possible to undertake during the experiments now described.

Movement in the offshore zone.—In the 1957 experiment,[1] no movement took place over a period of 7 weeks, under moderate wind and wave conditions at a site off the open coast. This position, some 2200* feet offshore and about 1½ miles north of the mouth of the River Ore, was used as a form of control for the 1959 offshore work. On 6 February 1959, 1000 pebbles treated with barium 140–lanthanum 140 were placed on the sea bed at this site, marked 1, in Figure 1, and which was common to the 1957 and the 1959 experiments. A further 1000 radioactive pebbles were injected at a point roughly half way between Site 1 and the shore. This position is marked 2, in Figure 1. The purpose of this experiment was to determine: (*a*) if

* In the paper in the *Journal* reporting the 1957 experiments,[1] this distance was inadvertently given as "nearly 700 yards" offshore, *Geogr. J.* **124**, 2 (1958).

under more severe weather conditions than obtained in 1957, movement was possible at Site 1; and (*b*) whether a greater degree of mobility occurred closer inshore. It was originally intended to develop this experiment by further injections still closer

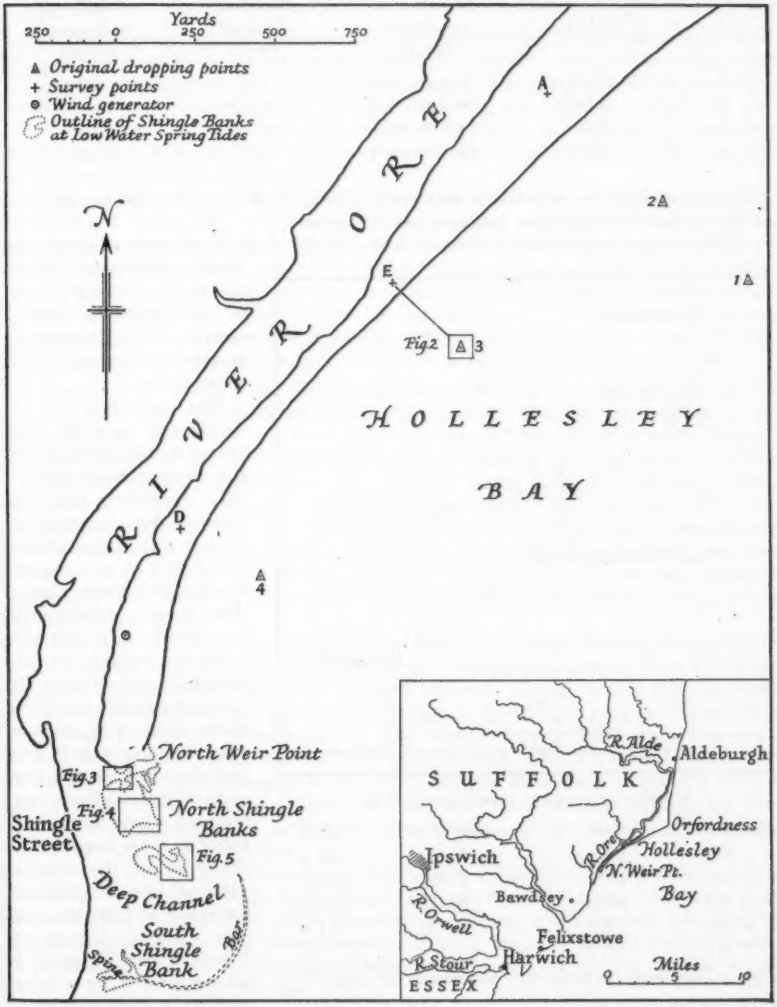


Figure 1

inshore in the same area. In the event, an area of high background radioactivity, which could have given rise to difficulties of interpretation, was discovered and the closer inshore injections were made on 25 February 1959, at two points further south. These are marked 3 and 4 in Figure 1. Table II gives a summary of the 4 injections in the offshore area and the amount of movement which took place.

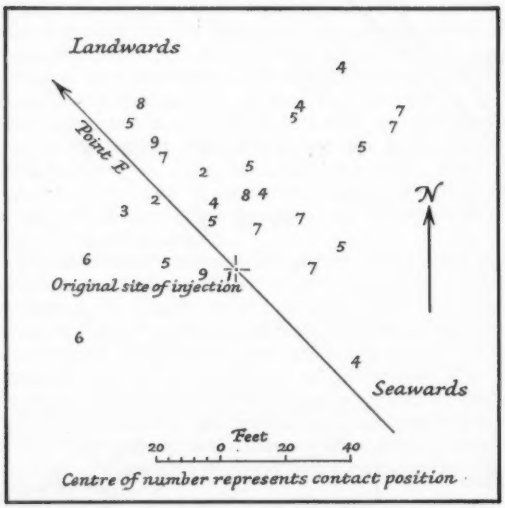
TABLE II

Offshore experiment

Site No.	*Distance offshore in feet*	*Duration of experiment (1959)*	*Maximum dispersal (feet)*	*Number of radioactive pebbles*
1	2200	6·2 to 9·4	134	1000
2	1060	6·2 to 9·4	151	,,
3	700	25·2 to 11·4	110	,,
4	665	25·2 to 11·4	108	,,

Site No. 3 has been selected as reasonably typical of all four sites and the progress of the marked pebbles there is illustrated in Figure 2.

All four sites, irrespective of distance from the shore, show the same characteristic pattern of dispersal. Movement seems to have been in all directions with a tendency to slightly greater travel shorewards and northwards.



Number of contacts shown in brackets

Sweep no.	*date*	*Sweep no.*	*date*
1 (1)	25/2	6 (2)	20/3
2 (2)	26/2	7 (6)	21/3
3 (1)	28/2	8 (2)	25/3
4 (5)	12/3	9 (2)	11/4
5 (7)	15/3		

Fig. 2. Offshore experiment: movement at Site "3". Injection on 25/3/59

The spreading of the radioactive pebbles appeared to take place at each site comparatively quickly and, thereafter, little additional dispersal was recorded. Contacts on sweeps at the end of two months showed little greater travel than those obtained after one month. The fact that it was still possible to locate pebbles coated with barium 140–lanthanum 140 after more than two months (that is, after 5 half-lives had elapsed) suggests that each of such contacts represented a large number of pebbles. This implies that the bulk of the original 1000 pebbles at each site remained in position, and the spread given in Figure 2 and Table II is accounted for by a comparatively small number of markers.

It is believed that the results obtained represent a genuine record of events. Repeated checking of the beach with scintillation counters makes it quite certain that no material reached the shore. The possibility remains, however, that some movement took place undetected. While a large area of sea bed around each site and between the sites was systematically searched, sweeping naturally tended to be most concentrated near the original injection points. On each sweep the geiger counter assembly

covered a path only about 5 feet wide. It is possible, therefore, that single pebbles may have travelled outside the zone of recorded dispersal and not been detected. It is significant nevertheless that, in more than 60 hours of controlled sweeping, not a single contact was made away from the immediate vicinity of the injection points.

The nature of the sea bed in the area varied considerably. Bottom samples secured with a Dutch grab showed a range from comparatively compacted coarse sand at Site 1 to fine sand at Site 4 and silt and mud at Site 3. It is possible on such a bottom that some loss of marked shingle could take place due to burial. The fact that the dispersal patterns remained essentially the same throughout the four sites would suggest, however, that such losses, if they took place, were slight and did not seriously affect the final picture.

While no site showed the complete absence of movement recorded in 1957, dispersal of 150 feet or less, over a period of two months, and under weather and wave conditions ranging from calm to gale, is remarkably small. Clearly no transfer of beach material between the offshore zone and the shore can take place, in this area, except, perhaps, under the most severe conditions. There were no significant differences between the sites 700 feet or less and that over 2000 feet from the shore. It is reasonable to suppose that movement of material between the beach and the sea bed is confined to a narrow zone immediately offshore.

Movement at the mouth of the River Ore.—At its mouth, the deep channel of the River Ore keeps to the west, or Shingle Street, side for about a quarter of a mile beyond North Weir Point, the distal end of the Orford spit. Then it turns abruptly eastward and flows out into the North Sea across a shingle bar. To the north of this eastward trending section of the deep channel, North Weir Point is, as it were, extended by shingle banks; in this paper, these banks are collectively called the North Shingle Banks. They are separated from North Weir Point by a swash channel which, while it has 8 feet of water at low water springs at its deepest part, has less than 2 feet at its shallowest. The North Shingle Banks are built of the same material as the spit: very largely flint shingle. At high water of spring tides they are covered by about 7 feet of water.

To the south of the deep channel of the Ore lies the South Shingle Bank, a much more elongated and a higher feature than its northern counterpart. It is separated from the Shingle Street shore by a shallow channel, through which the tide flows rapidly, at both the ebb and the flood, as it does in the channel between North Weir Point and the North Shingle Banks. The South Shingle Bank runs west–east, at right angles to the coast. Its "tail" curves northwards to form the bar at the mouth of the Ore. At the highest part of the South Shingle Bank there is about 1 foot of water at high water springs, and on the bar, the depth nowhere exceeds 14 feet. The position and extent of all the shingle banks are subject to rapid changes and depths of water fluctuate widely.

The 1957 experiments showed that beach material could cross the mouth of the River Ore and reach Shingle Street from the North Weir Point area. While the path of the marked pebbles could not be traced with certainty, it was inferred that material which reached North Weir Point moved, either up the river side of Orford Beach, or crossed, first to the North Shingle Banks and, thence, via the bar and the South Shingle Bank, to Shingle Street.

The 1959 experiments were designed to determine the precise path which shingle took in crossing the estuary, and the conditions of weather and tide under which such movement could take place. The plan was to inject pebbles, treated with lanthanum 140, an isotope with the comparatively short half-life of 40 hours, on several occasions. It was hoped that, by injecting the second and subsequent batches of marked pebbles at points indicated by the results from the preceding injection, a composite and complete picture of movements in the estuary could be built up. Three injections of such radioactive pebbles were made and these were

supplemented by two small batches of marine painted pebbles for reasons already noted. Table III gives a summary of the 5 injections in the shingle bank area and the amount of movement which took place. Plate 3 shows the last of these injections.

TABLE III

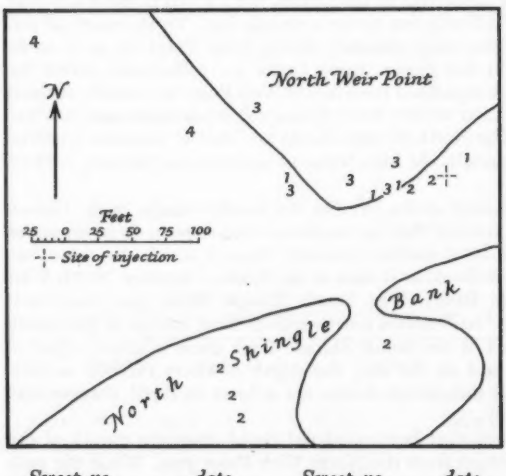
Shingle Bank Experiment

Injection Site No.	*Duration of experiment (1959)*	*Maximum dispersal (feet)*	*No. of radioactive pebbles*
1	6·2 to 10·2	332	600
2	26·2 to 4·3	NIL	600
3	9·3 to 12·3	168	100*
4	12·3 to 13·4	238	85*
5	7·4 to 13·4	222	600

* Marine painted pebbles.

The location of both the offshore and the shingle bank experiments may be seen on the general map, Figure 1; the three rivermouth areas in which injections were made are shown in detail on Figures 3, 4 and 5, and also on Plates 2–4.

The first injection of radioactive pebbles was made at low water on the afternoon of 6 February 1959 at North Weir Point (Fig. 3); 600 pebbles treated with lanthanum 140 were deposited just offshore. Tracing was possible on each of the four succeeding days using the geiger counter assembly at high water. Figure 3 indicates that travel was almost entirely upriver. It also shows clearly that some shingle was able to cross the swash channel and reach the North Shingle Banks. Maximum movement was of the order of 330 feet. The pebbles which reached the shingle bank were found some 250 feet from the point of injection. During the four days of tracing, wave heights never exceeded 9 inches. The effectiveness of quite small waves, acting in concert with the rapid waterflow of the flood tide, is clearly demonstrated. The importance of the interaction of these two forces is indicated by the inability of the faster flowing ebb tide to move material in a direction opposite to that of wave approach.



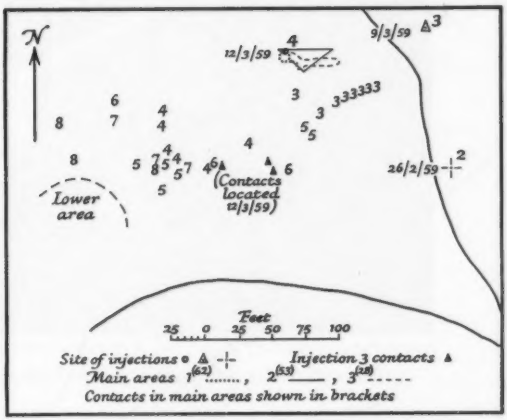
Sweep no.	*date*	*Sweep no.*	*date*
1	7/2	3	9/2
2	8/2	4	10/2

Fig. 3. Shingle bank experiment: Injection 1, 6/2/59

A further 600 pebbles marked with lanthanum 140 were deposited on the North Shingle Banks at low tide on the morning of February 26 (Injection 2, Fig. 4). During the succeeding 5 days, when tracing was possible, the weather was calm and

sometimes foggy. Gentle swells did not produce even small breakers on the seaward sides of the shingle banks. Despite the very strong tidal currents in the area, no movement of any kind took place. The small hummock of marked pebbles on the shingle bank remained long after the radioactivity had been dissipated. While this phase of the shingle bank experiment proved abortive, it did serve as a convincing demonstration of the ineffectiveness of current action, in isolation, in transporting shingle.

The purpose of this second injection of pebbles had been to trace the subsequent history of shingle thrown up on the seaward side of the North Shingle Banks. In order to avoid delay, a number of pebbles were coated with an orange marine paint, of proved ability to withstand abrasion on the beach. These were deposited on the North Shingle Banks (Injections 3 and 4, Fig. 4) in two parts. At low water in the afternoon of 9 March 1959, 100 painted pebbles were deposited on the shingle bank in a comparable position to the abortive lanthanum 140 injection. Stormy conditions prevailed at the time of placing the marked pebbles, and breakers on the edge of the shingle bank were about 2 feet high. The injection of pebbles coincided with neap tides, which meant that the shingle banks were covered and subjected to wave attack for a long period each day. No pebbles could be traced on the following day and the hummocky appearance of the surface of the shingle bank made it apparent that the marked pebbles were buried by newly arrived shingle thrown on to the bank by the storm waves. The bulk of the pebbles remained buried but three days after injection, three pebbles, which had travelled 160 feet towards the river channel, were found.



Injection 4 contacts

Sweep no.	*date*	*Sweep no.*	*date*
1	13/3	5	25/3
2	14/3	6	8/4
3	15/3	7	11/4
4	22/3	8	13/4

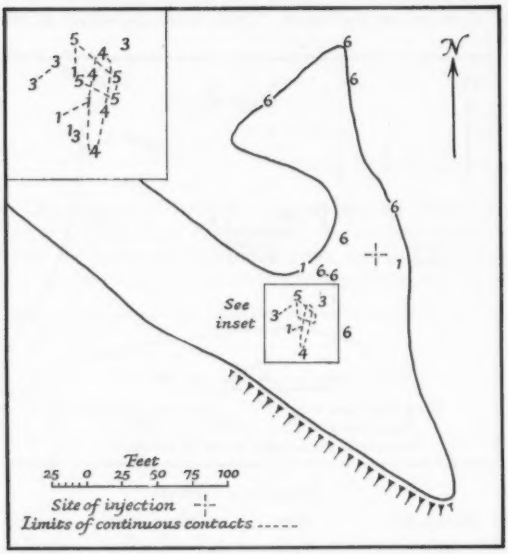
Fig. 4. Shingle Bank experiment: Injections 2, 3, 4

A further batch of similarly marked pebbles were placed in position on the North Shingle Banks on March 12. Calmer weather and moderate wave conditions in the next three days resulted in only a little movement. A gradual spread up to about 20 feet from the injection point took place and individual pebbles moved about twice this distance. All movement was toward the river channel. The progression riverwards continued and after 10 days 5 pebbles were 120 feet or more from the point of origin. Movement continued until April 13, when the whole experiment was terminated. By this time travel of the order of 180 feet had taken place and was always from the seaward towards the riverward side of the shingle bank.

The third and final injection of pebbles marked with lanthanum 140 took place on 7 April 1959 (Injection 5, Fig. 5). The point of injection was close to the extreme southern tip on the seaward side of the North Shingle Banks. In the ensuing four

days, in which wind strengths reached the highest figures recorded during the whole experiment, surprisingly little movement took place. Winds over 20 knots, with gusts of up to 42 knots seemed to have little effect on the shingle banks and it is clear that winds from the south-west, that is, offshore winds, however strong, produce little movement on the North Shingle Banks. Thorough sweeping over a very wide area, using both a towed sledge-mounted scintillation counter and the second similar instrument, which was carried, make it very improbable that undetected movement took place.

On the fifth and the last day on which tracing was possible, movement of the order of 160 feet from the point of injection, and of over 200 feet from the nearest of the previous day's contacts, took place. All the movement was northwards and seawards, that is, in a direction counter to anything previously recorded. This was achieved with winds of moderate strength from the south and with waves approaching from the same direction.



Sweep no.	*date*	*Sweep no.*	*date*
1	8/4	4	11/4
2	9/4	5	12/4
3	10/4	6	13/4

Fig. 5. Shingle Bank experiment: Injection 5, 7/4/59

The experiments at the mouth of the River Ore showed that, once material had reached the end of the shingle spit at North Weir Point, there was a marked tendency for it to travel into the mouth of the river rather than across it, or towards the offshore zone. Only on one day throughout a two-month period was there a counter movement. This occurred while southerly winds were blowing; when, in fact, the direction of wave approach tended to coincide with the direction of the ebb current, close to the point near the bar where it turns north along the coast. While some pebbles crossed from North Weir Point to the North Shingle Banks this appeared to be simply in transit riverwards.

The evidence of the experiments suggests that once shingle reaches the gently sloping seaward side of the North Shingle Banks, it progresses slowly over the banks to the steep side fronting the deep channel of the river. Here it is buried under shingle which arrives at a later stage. Hydrographic survey over the last four years has shown that the shingle banks are growing in this direction. There is no suggestion of movement of shingle by current action along this steep inner face of the banks.

The 1959 experiments at the mouth of the River Ore showed that some of the inferences from the 1957 results require modification. The suggested path of material which crossed the estuary, that is, by way of the shingle banks and the bar, is now seen to be improbable. Material reaching the North Shingle Banks tends to remain

Photograph: J. K. St. Joseph, Crown copyright reserved

Aerial view of experimental sites (photograph taken June 1949)

Using underwater detecting equipment, North Shingle Bank

Unpacking lanthanum 140 from Harwell on North Shingle Bank at low tide

Using scintillation counter equipment on South Shingle Bank (Shingle Street mainland in background)

there. The inference is clear. Shingle which succeeds in crossing the estuary must leave the spit well north of the distal point, and travel round the outer edges of the shingle banks and across the bar. Once on the North Shingle Banks it is effectively removed from circulation for a long period, unless winds from the south return it to the zone where longshore travel is possible.

Conclusions.—The experiments described above have suggested that in the area of Orford Beach, movement in the offshore zone is very limited even under quite severe weather conditions. The exchange of material between the shore and the offshore area must be confined to a very narrow zone. In the mouth of the river, the work has demonstrated the power of quite small waves, acting together with tidal currents, to move large beach material. It has shown the inability of very strong currents to transport large material in a direction counter to that of wave approach. The experiments have also given good ground for believing that movement across the estuary takes place on the outside of the arc formed by the shingle banks and the bar, rather than by using the shingle banks as a kind of "stepping stone." The value of the technique of radioactive marking has again been demonstrated. Enough has been learnt of the limitations of the method, however, both in cost and lack of flexibility as well as in the possibilities of error, to encourage the search for a still more satisfactory technique. The use of fluorescent materials for marking sand, and the tracing of its subsequent movement by the use of ultra-violet light, has been pioneered by Russian scientists.[6] It may be possible to adapt this method to shingle. Until this has been done, the radioactive technique will remain the only really practicable method of tracing movement of shingle over the sea bed.

REFERENCES

[1] Kidson, C., A. P. Carr and D. B. Smith, "Further experiments using radioactive methods to detect the movement of shingle over the sea bed and alongshore." *Geogr. J.* **124,** 2 (1958) pp. 210–18.

[2] Kidson, C., D. B. Smith and J. A. Steers, "Drift experiments with radioactive pebbles." *Nature,* **178** (1956) p. 257.

[3] Steers J. A., and D. B. Smith, "Detection of movement of pebbles on the sea floor by radioactive methods." *Geogr. J.* **122,** 3 (1956) pp. 343–5.

[4] 'Atlas of Tides and Tidal Streams. British Islands and adjacent waters.' Hydrographic Department, Admiralty 1952.

[5] Admiralty Chart B. 5833. "River Ore and Approaches." 1897.

[6] Zenkovitch, V. P., 1958. "Emploi des luminophores pour l'étude du mouvement des alluvions sablonneuses." Bulletin d'Information C.O.E.C. X Année, No. 5. Mai 1958. pp. 243–53.

INVESTIGATIONS INTO THE SOILS AND AGRICULTURE OF THE LOWER DIYĀLA AREA OF EASTERN IRAQ

C. W. MITCHELL

The Diyāla project

THE DIYĀLA RIVER in winter carries more than sufficient water for all irrigation needs, sometimes even causing serious floods, but in summer it is so reduced that only a small area can be cropped. The Iraq Development Board initiated the building of the Derbendi-Khan dam on the upper Diyāla in 1951 to control these variations, in order to extend the limits and intensify the use of the present cultivated area in summer, and prevent flooding in the winter. A firm of consulting engineers, Sir Murdoch Macdonald and Partners, was commissioned to advise on the irrigation development of the whole river basin. They employed Hunting Technical Services Limited to study and map the soils, to assess their value for irrigation, and to study agricultural methods both in the irrigated areas and the upper catchment.

The Diyāla and its tributaries drain an area of 11,800 sq. miles in the Cretaceous, Eocene and Oligocene fold ranges of western Persia and eastern Iraq. They fall rapidly from heights of over 12,000 feet to the Miocene gypsum, marl and red sandstone hills of the Fars Series and the Pliocene Bakhtiari gravels which outcrop at the edge of the Mesopotamian lowland. The Diyāla breaks through these parallel fold ranges transversely in a series of discordant gorges. As the hills decrease in height westwards, the lateral alluvial basins increase in size until the river finally emerges from the Jabal Hamrīn on to the Mesopotamian plain.

The "Diyāla Scheme" concerns the whole river valley and catchment area, but has been divided for convenience into the "Upper Diyāla," the hilly country lying north of the gorge at Jabal Tuna Charkana; "Middle Diyāla," the undulating country of parallel ridges and intermontane troughs between Jabal Tuna Charkana and Jabal Hamrin; and "Lower Diyāla," which is defined as that area which is commanded by gravity irrigation canals drawn off at Diyāla Weir. This weir is situated where the river emerges from the Jabal Hamrīn near the town of Muqdādiya (Shahrābān). From it flow five canals on the left bank and one on the right bank which command a large well-defined area bounded on the north-east by the mountains, on the west by the river Tigris, and on the north-west and south by deserts (Plate 1).

The Lower Diyāla area

History.[1]—The history of settlement of the Lower Diyāla area is very ancient, going back to the Ubaid and Warka periods when some irrigation from small local canals was practised. The first flourishing came in the Proto-Literate and Early Dynastic Periods (*c.* 3600–2300 B.C.) when major canal systems were created, and brought a prosperity which lasted until after the Gutian invasion when some contraction of cultivation took place (*c.* 2150 B.C.). The region prospered again, however, under the Third Dynasty of Ur, and continued in fair stability under more or less independent local governors at Eshnunna (Tel Asmar) for half a millennium. There was a general decline after about 1700 B.C., accompanied by a considerable abandonment of settlement. The ancient sites of Tel Asman, Tel Agrab and Khafaji are marked with small circles on the map facing p. 392.

Little is then known about the region for a long period. It was a route for armies under the Kassite, Assyrian and Neo-Babylonian empires. It entered a new era of growing prosperity under the Achaemenian Persians in 537 B.C., which was to continue

[1] Derived from information given by Professor T. Jacobsen of Chicago University.

for more than 1000 years through Seleucid (*c.* 311–150 B.C.) and Parthian (*c.* 150 B.C.–A.D. 226) times to reach its peak towards the middle of the Sassanian Period (A.D. 226–637). From Sassanian times dates the gigantic Nahrwān canal which brought water

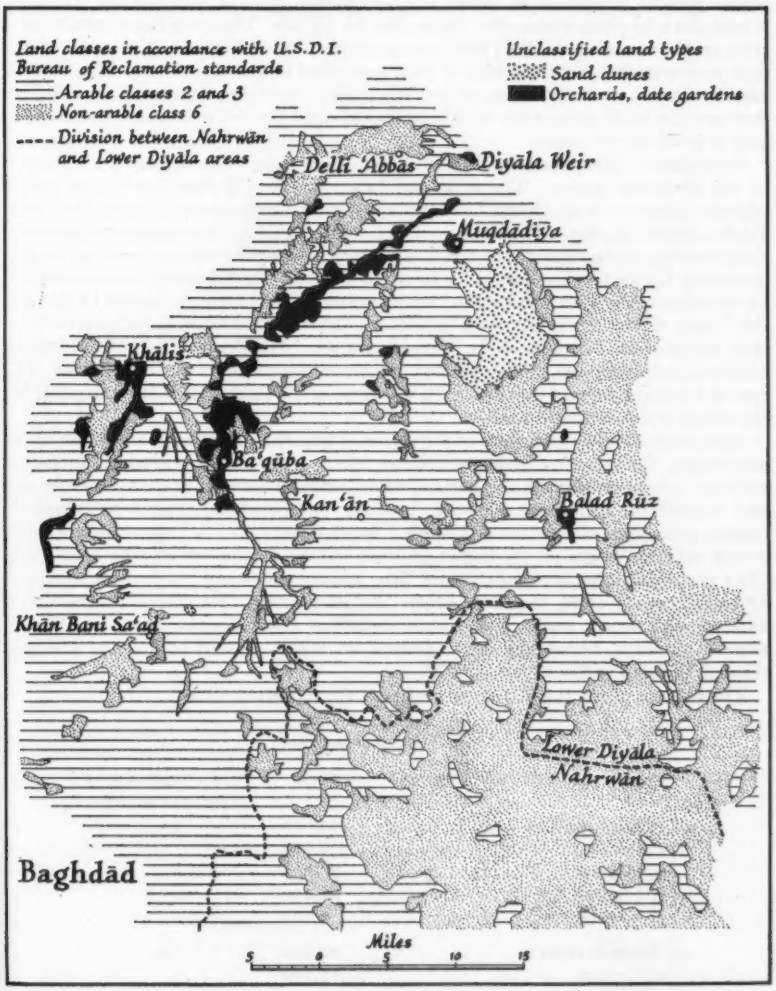


Figure 1

from the Tigris above Sāmarra to the middle and southern part of the Diyāla region and also the ruins of Dastagerd, built as a capital city by Chosroes II and shown on the map facing p. 392 and Plate 2. In no other period before or since has theDiyāla region been so populous and extensively cultivated. After the Islamic conquests, recovery was intermittent until worsening political conditions again caused decline and left little of the earlier prosperity for the Mongols to destroy when they invaded Iraq under

Hulagu Khan in A.D. 1258. From this date until the present century, little advance was made.

Present uses.—Almost all agriculture in the area is dependent upon gravity irrigation whose present pattern is as shown on the folding map, although some irrigation is now done by pumps from the Tigris and the Diyāla. The only large uncultivated areas are the foot-slopes of the Jabal Hamrīn and the "sandhills" area which, apart from their poorness of soil, are too high to be commanded by canals from the Diyāla Weir, and the deserts east and south of the Rūz Canal which are highly saline, although they contain small sump areas which gather sufficient run-off to be somewhat leached and to grow cereal crops.

Population.—The density and distribution of the population is mainly a reflection of the irrigation pattern. The total population of the 3 *qadhas* (townships) and 5 *nahiyas* (districts) of the Diyāla Liwa (Province) which approximately cover the Lower Diyāla area is 200,663.[1] The largest town, Ba'qūba (18,547), lies astride the Khurāsān Canal among extensive orchards and date gardens beside the main road and rail bridges across the Diyāla (Pl. 2). Except for Khān Bani Sa'ad, which is an old caravan station on the main route from Baghdad to Persia, and some small towns along the Diyāla and the Tigris, all the other important settlements in the region lie on major canals where they are crossed by main roads. The largest are Muqdādiya (Shahrābān) (7626), Khālis (Diltāwa) (5512), and Balad Rūz (3618), on the canals of the same names. The rest of the population of the area, or 82 per cent. of the total, live in 683 villages along the canals and their distributaries.

Agriculture.—The agriculture of the region is largely concentrated on winter barley and wheat. Other winter crops are linseed, lucerne, beans and vegetables, including cabbage, beetroots, spinach and lettuce, while the main summer crops are cotton, rice and vegetables, including tomatoes, melons, water-melons, marrows, egg-plant, onions, pumpkins, cucumbers and *bamia* ("lady's fingers"). The vegetables tend to be grown near to villages on the higher ground, and the rice in low marshy areas. The chief perennial crops are dates, citrus, figs, pomegranates and mulberries, grown in orchards, mainly along the large canals and near towns (Fig. 1). The agricultural livestock are sheep, cattle, goats, water-buffaloes and chickens, and the domestic animals, donkeys, horses and dogs. Camels are mainly owned by nomads who pass through the area without residing in it.

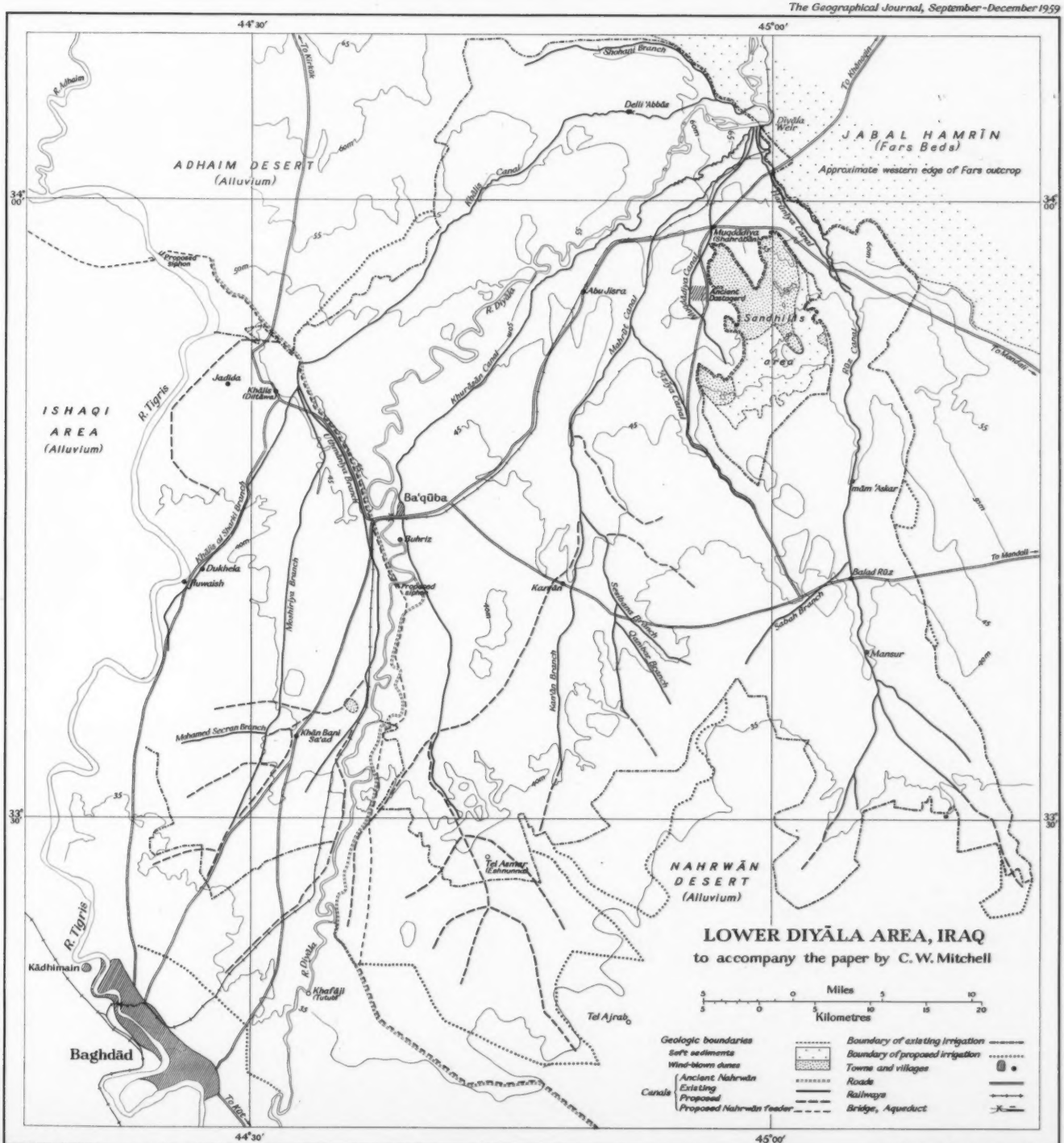
The acreage of the main crops is shown in the following table:

Lower Diyāla crop areas[2]

	Acres	% *of irrigated area* (731,341 *acres*)
1. *Winter crops*	304,600	44
a. Barley	199,000	
b. Wheat	77,200	
c. Linseed	22,200	
d. Vegetables	6,200	
2. *Summer crops*	28,500	4
a. Cotton	17,100	
b. Vegetables	4,900	
c. Rice	2,500	
d. Sesame	2,100	
e. Miscellaneous	1,900	
3. *Perennial crops*..	29,700	4

[1] Population figures from general population Census for Iraq for 1957.

[2] Derived from 1956–7 Ministry of Agriculture estimates except for figures for summer vegetables and perennial crops which are from the 1952–3 Agricultural Census.



Published by the Royal Geographical Society

Based on map for Iraq Development Board by Sir Murdoch Macdonald & Partners

Most of the farming is done by peasant share-croppers who usually receive between two-fifths and three-fifths of most crops, depending on whether the landlord provides water, seed, credit or machinery. Wheat, barley and vegetables are sown in late autumn, and are watered and tended throughout the winter. Cereals are harvested in May and June, threshed in July and winnowed by the end of September. Cotton and the summer vegetables are sown in March and April, and rice in May, June and July. Cotton picking begins in August, and continues until the harvesting and threshing of rice in late autumn.

Soils

Parent material.—The soils of the area are developed on two main types of parent material: the Miocene Fars sediments with their associated colluvium, and the recent river alluvium. There are two sedimentary outcrops in the area; the Jabal Hamrīn, and the southern part of the "sandhills" area. The Jabal Hamrīn consists of anticlinally folded sandstones, conglomerates and gypsum beds, which disappear fairly abruptly into the alluvium, along a line bounding the north-east edge of the Lower Diyāla area (folding map). The southern part of the "sandhills" area is a soft gypseous shelly sandstone from which an area of rolling sand dunes to the north appears to have been derived. In many places the surface is white with salt, whose presence is due to evaporation from a shallow water table. In the south of the area are some ponds which fill in the winter, but have a thick salt incrustation when they evaporate partly or completely in the summer. They seem to be impounded at the surface by local underlying impervious layers. Movement of the dunes is restricted by the abundance of the halophytic vegetation they support. The area is too high, dry and salty for most of the year to provide more than poor grazing for the Bedouin, who must share it with a native fauna of wild pigs, jackals and porcupines.

All the rest of the Lower Diyāla region is a flat alluvial plain falling very gently towards the south. The alluvium is highly calcareous and is derived from the highland zone to the north and east whence it has been transported over the centuries by rivers and canals. Its texture varies according to the speed of flow of the water from which it was deposited. Sediments from the rivers and larger canals tend to be sandy; those from smaller canals are dominantly silty, while those laid down in relatively still water far from the main flow have a higher percentage of clay, although silt is usually the dominant fraction even here.

Topography.—The pattern of deposition governs the topography. The plain has been irrigated for so long that abandoned *tels* and ancient canal lines, which often follow still more ancient levees, form a network over the whole Diyāla area, clearly visible on aerial photographs (Plate 1). Canals which have been abandoned in the past two millennia normally stand up as long narrow salty ridges up to about 10 feet high running across the plain. These separate lower places, usually cultivated, whose impeded surface drainage causes them to form seasonal ponds and marshes and leads to the development of *gilgai* soils and micro-relief.

Soil-forming agents.—The climate of the Lower Diyāla area is semi-arid. The meagre winter rainfall is insufficient to cause more than surface leaching, even where it is concentrated by the topography into ponds and marshes, while the long, hot summer effectively dries the soil to a depth of about a metre. The soil moisture is, however, increased by the irrigation water. The mean usable flow of the Diyāla is at present approximately 1340 cusecs. As a rough approximation and neglecting all local topographic variations, this amount taken over a whole year would cover the 1850 sq. miles of the Lower Diyāla area to a depth of approximately 9·8 inches. The mean annual rainfall at Baghdad[1] for the period 1938–50 was only 5·5 inches. This suggests that the average contribution from irrigation to soil moisture is considerably greater than that from rainfall. Vegetation and fauna, including the activities of man, play some part in soil formation, but little organic matter remains in the soil. The

[1] Slightly lower than the average for the Diyāla area.

deep roots of some weeds, notably *shok* (*Prosopis farcta*) assists oil permeability, while burrowing fauna such as jerboas, earthworms, termites and ants assist in aeration.

Soil processes.—The two soil processes which are mainly responsible for pedogenesis on the alluvial plain are salt movement and the degradation of structure. Soil salinity is one of the main restrictions to agriculture, and the average salt content of the top 5 feet over the whole area is approximately 0·35 per cent. (an electro-conductivity on saturated extract of 7·92 mmhos/cm at 25°C), although it varies widely from place to place. Salt is continually being added in irrigation water and, on the whole, it tends to move down the profiles to the water table, so that the ground water is almost always saltier than the soil. Although subsoil drainage is usually adequate, high water tables in places bring water to the surface where evaporation causes crystallization of dissolved salts. This is especially common around the sandhills area and beside large canals which carry water above ground level. It is thought that the large salt deserts in this part of Iraq owe their origin to past irrigation which was not adequately drained and allowed a build-up of salt which has subsequently risen to the surface layers of the soil.

Degradation of structure is a ubiquitous phenomenon whose mechanism is not yet clearly understood. It results from the seasonal wetting and drying of fine textural soils in low places. In the winter, water stands on areas of internal drainage, where lateral escape is prevented by natural levees, sand dunes, or both ancient and modern canal banks, so that wide, shallow ponds are formed which stand for several months before finally evaporating or draining away during the summer. This alternation of conditions causes a change of the physical and perhaps also the chemical properties of the underlying soil, so that, when dry, the surface cracks widely and quite deeply, developing the characteristic *gilgai* micro-relief, and the subsoil becomes extremely hard. The vertical difference between the two is not more than about ten feet.

Soil classification.—The soil classification is based on a consideration of the qualities which determine the value of irrigable lands in the U.S. Department of the Interior 'Bureau of Reclamation Manual,' Vol. 5. It is essentially a tabulation of every possible combination of the three variables: texture, structure and salinity. Two main textural groups are recognized, so that all soils are considered to be either coarse or fine. A coarse soil is one which is dominantly loam, sandy loam, loamy sand, or light silt loam (under 20 per cent. clay), on the U.S. Department of Agriculture textural triangle.[1] A fine soil is one which lies dominantly in the clay, silty clay, clay loam, silty clay loam, or heavy silt loam (over 20 per cent. clay) classes. Where a heavy soil has a dominantly coarse textured subsoil within 5 feet of the surface, it is considered that general permeability and drainage will be improved, and separate subclasses of the main series are recognized and mapped. The second variable is salinity, of which there are three classes: low, medium and high reflecting electro-conductivities on a saturation extract from the soil of less than 8, 8–15 and more than 15 mmhos per cm which are more or less equivalent to salt percentages of 0–0·35, 0·35–0·65 and over 0·65 respectively. Thirdly, all sites were graded according to their degree of approach to *gilgai* characteristics into those with satisfactory, poor or bad structure for agricultural use. Certain other land types were recognized which lay within the area, but were excluded from the soil survey for various reasons. These included *tels* and old canal lines, town and village sites, orchards and sand dunes.

Land classification

The land classes shown on Fig. 5 follow the soil classes. Only three of the six groups in the U.S. Department of the Interior 'Bureau of Reclamation Manual' were used: classes 2, 3 and 6, in decreasing order of agricultural value. Any land with either high

[1] 'Soil Survey Manual,' p. 209. Size limits of soil separates are: clay below 0·002 mm.; silt 0·002–0·05 mm.; sand 0·005–2·0 mm.

1. Oblique view of Diyāla Weir, looking east *Photograph: Hunting Aerosurveys, 1956*

Photograph: Hunting Aerosur

2. Ba'qūba, the Diyāla and the ancient Nahrwān Canal

salinity or bad structure became class 6, and with either medium salinity or poor structure became class 3, while land with neither of these limitations became class 2. Miscellaneous land types were given no land class as they were considered to be outside the scope of the survey. The following amounts and percentages of each land class were found:

Land class	*Acres*	*% of total*
Class 2	291,900	24
Class 3	443,300	37
Class 6	404,200	33
Orchards	35,800	3
Miscellaneous (*tels*, canals, towns, villages, etc.)	35,800	3
Total	1,211,000	100

61 per cent. of the land falls into classes 2 and 3 (Fig. 1) and is considered suitable for irrigation, and even a proportion of class 6 land may be reclaimable. Accordingly, considerable development of the area has been advised, and agricultural studies were made to determine the pattern it should take.

Anticipated results of survey

The main recommendations have been the following:

First, existing canalization is to be remodelled approximately as shown on the map 1. Secondly, as the proposed developments will more than double the application of irrigation water, drainage must be installed as a first priority to guard against the danger of salinization from rising water tables. Thirdly, the whole farming system should be improved in three directions. First, summer cropping should be much increased. It should be possible to double the areas under cotton and vegetables, and to increase the area under rice five-fold. Secondly, the increased water and improved drainage should make possible a departure from the present dependence of the farming system on a biennial fallow. "Basically, the change should be towards a more intensive system of farming, one which will raise soil fertility through the adoption of a rotation containing some restorative crop, supplemented by the greater use of livestock and of fertilizers."[1] Two possible new rotations have been suggested based on the use of *berseem*, a leguminous fodder crop, which the Department of Agriculture is already promoting on a wide scale. The first of these has one crop of *berseem* after one season of fallow and two of winter cereals, and is intended for use during the transitional period until fully intensive farming can be introduced. Ultimately, the area under fodder crops should be increased to approximately a third of the arable land if livestock are to play their full role in the future economy of the country. The fully intensive rotation which is recommended as the ultimate aim allows for a three-year cycle of winter cereal followed by *berseem* and spring-sown cotton, fodder, vegetables or rice. This rotation would eliminate winter fallowing except for the period before the spring-sown crop. This intensification of the farming system will reduce the amount of *shok* bush (*Prosopis farcta*), which is the main, though even now inadequate, source of domestic fuel in the countryside. Some consideration will have to be given to the provision of a better and more abundant fuel supply, perhaps from irrigated tree plots, which would also serve as shelter belts, for building timber and general amenity.

The third main direction for development of the farming system is the improvement of agricultural practices. Experiments are needed to determine optimum planting dates, seed rates, better varieties of plants and stock, the value of artificial

[1] Macdonald (1958). 'Lower Diyāla development.'

fertilizers and the best methods of weed control. Some beginning has been made towards these objectives. Experimental plots were laid out in various parts of the area on which the yields of several crops were measured in relation to different seed rates and fertilizer and manurial treatments during the 1956–8 seasons.

Improvements are needed in tools and increased mechanization should be encouraged. Only a small range of agricultural tools are used. For instance, all hand-harvested grain is still cut with small sickles. Mechanization is increasing, particularly on some of the larger farms near Baghdad, where some land is ploughed by tractor and cereals are reaped by combine harvester, but this is still exceptional and the cost of purchase and maintenance of machinery is still prohibitive on all but the largest estates. Much better control is needed over the management and application of water, so that localized damage through drought or flooding can be avoided, and such dangers as the gully erosion near the Tigris and Diyāla rivers contained (Pl. 2). Finally, the present extension services proved by a few local agricultural advisory officers should be expanded in order to publicize improvements to the cultivators.

Acknowledgement.—My thanks are due to the Minister of Development of the Iraq Government, to Sayid Mahmoud Hassan, Director General of the First Technical Section, and to Sir M. Macdonald & Partners, for permission to publish the information contained in this paper, which was derived from studies done for them on the Diyāla-Middle Tigris Projects. I wish to thank my employers, Hunting Technical Services Ltd., and also Hunting Aerosurveys Ltd., for the facilities they granted me for preparing the paper and for providing the photographs.

More specifically, I wish to thank Mr. V. C. Robertson, Dr. T. N. Jewitt, and Dr. R. Smith, and all my colleagues of Hunting Technical Services Ltd., without whose help this could not have been written, and all the other British and Iraqi staff of the company, whose work I have drawn on.

BIBLIOGRAPHY

Admiralty Naval Staff Intelligence Dept. (1918). 'Geology of Mesopotamia and its Borderlands.'

Binnie, Deacon and Gourley (1956). 'Report to the Development Board, Government of Iraq, on the Z.A.D., Nahrwān, Adhaim and Ishaqi Projects,' London and Baghdad, Vol. II.

Bureau of Reclamation Manual (1951). Vol. 5, 'Irrigated land use.' U.S. Department of the Interior, Bureau of Reclamation, Denver, Colorado.

Harris, S. A. (1958). "The *gilgaied* and bad-structured soils of Central Iraq," *J. Soil Sci.*, 9, No. 2.

Hitchen, C. S. (1948). 'Report on geology of the Tharthar Depression, Iraq.' With special reference to its use as a reservoir for flood control on the River Tigris.

International Bank for Reconstruction and Development (1952). 'The economic development of Iraq.' Report of a mission organized at the request of the Government of Iraq. Published for International Bank for Reconstruction and Development by Johns Hopkins Press.

Ionides, M. G. (1937). 'The regime of the rivers Euphrates and Tigris,' E. and F. N. Spon Ltd., London.

Iraq Government Agricultural Census, for Diyāla Liwa (1952–3).

Irrigation Development Commission (1951), President: F. F. Haigh, C.I.E., M.I.C.E. Iraq Government Directorate General of Irrigation. Report on the control of the rivers of Iraq and the utilization of their waters.

Knappen, Tippetts, Abbett, McCarthy, Engineers (1952). Development Plan for the Tigris and Euphrates Rivers, Iraq. Government of Iraq Development Board.

Lees, G. M. and N. L. Falcon (1952). "The geographical history of the Mesopotamian Plains," *Geogr. J.*, **118**, pp. 24–39.

Lees, G. M. (1938). "The geology of the oilfield belt of Iran and Iraq," in 'The science of petroleum.'

Macdonald, Sir Murdoch and Partners (1958). 'Lower Diyāla Development. Diyāla and Middle Tigris Projects, Report No. 2.' Government of Iraq Development Board. First Technical Section.

Naval Intelligence Division (1944). 'Iraq and the Persian Gulf.' Geographical Handbook Series.

Russell, J. C. (1956). "Historical aspects of soil salinity in Iraq." A paper presented at a "Soil, salt and settlement" seminar of I.C.A. and F.A.O. personnel and invited guests. 30 January 1956, I.C.A. Conference Room, Baghdad, Iraq.

Smith, R. (1957). "The relationship between water quality and drainage characteristics of some Iraq soils." Third Cong. Internat. Comm. Irrigation and Drainage. San Francisco. Question 10. R.1. 1–26.

Smith, R. and V. C. Robertson (1956). "A classification of the saline soils of the old irrigation lands of the Middle Tigris Valley." Sixth Internat. Cong. Soil Sci., D. 693–8.

Tippetts, Abbett, McCarthy, Stratton, Engineers, Inc. (1957). 'Symposium on drainage problems in connection with irrigation projects of southern Iraq.' Government of Iraq. Development Board, Ministry of Development, Baghdad, Iraq.

United States Department of Agriculture (1951). 'Soil Survey Manual.' Handbook No. 18. Soil Survey Staff, Bureau of Plant Industry, Soils and Agricultural Engineering. Superintendent of Documents, Government Printing Office, Washington, D.C.

THE COMMERCIAL USE OF PEAT IN NORTHERN IRELAND

JAMES H. JOHNSON

IN AN EFFORT TO USE ITS NATIVE NATURAL RESOURCES to the utmost, the Republic of Ireland has been exploiting its peat bogs as a source of electrical power. Several accounts of this development have appeared,[1] but none of them refer to the comparative position in the six counties of Northern Ireland, for the very adequate reason that little commercial use has been made of peat there. At first sight the neglect of this resource presents a problem, since Northern Ireland, with some of the highest unemployment figures in the United Kingdom, lacks local fuel, a fact which is held to inhibit industrial development. Indeed, the Government of Northern Ireland feels it necessary to spend three-quarters of a million pounds in subsidizing coal supplies to industrialists[2] and might well be expected to use fuel resources within Ulster as fully as possible.

One reason for this apparent omission is revealed by the results of the recently published Northern Ireland Peat Bog Survey.[3] This survey was undertaken during the summers of 1952 and 1953; and in the final report the potential peat reserves of the country are estimated. Although 600,000 acres in Northern Ireland, about one-fifth of the land surface, are covered with a discontinuous layer of peat, much of the deposit is only 2 or 3 feet deep and some is less than 12 inches thick. Four-fifths of the bogland of Northern Ireland is blanket bog which has deep areas only in small patches, although it contains some of the best peat. Basin bog covers 100,000 acres, but more than two-thirds of its area is useless for commercial working, as it has been heavily cut-over or made agriculturally productive.

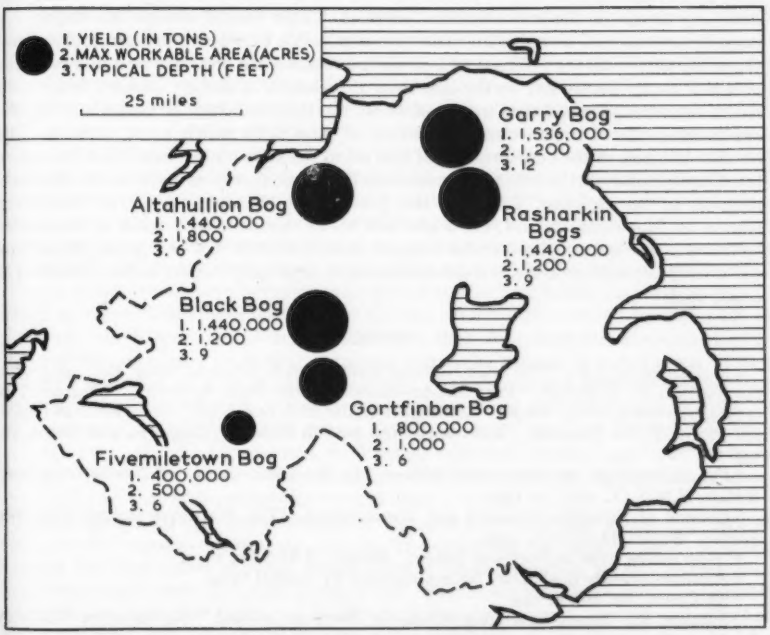
Most of the peat is found in Londonderry, Tyrone and Fermanagh, although in eastern Antrim there are areas of fairly deep blanket bog in patches which seldom exceed 300 acres. In Londonderry and Tyrone the best peat is found in the Sperrin mountains, where the gradients are usually too severe to allow any great depth to accumulate except in small pockets. In Fermanagh there are more basin bogs than elsewhere, and on the higher ground extensive areas of blanket bog. The blanket bog, however, is on steep slopes and would be difficult to exploit, while the basin bog is in scattered patches and its peat has a high ash content. Taking the country as a whole there may be 30,000 acres of uncut usable bog, most of this in areas of less than 250 acres; the basin bogs are small and the hill bogs often have steep gradients, both of which factors make difficult the mechanical winning of peat. In all there are only six patches of over 1000 acres with a depth of peat of more than six feet, and in no case does the workable area exceed 2000 acres (see map). Most of these areas are located away from the industrial zone of north-east Ireland, so that as a source of power they can only be used for the generation of electricity.

It is not, therefore, surprising that there has been little commercial exploitation of the Ulster bogs, although they have not been entirely neglected. Two firms produce peat litter, which can be used for poultry bedding, as a packing material and as an ingredient in some animal foods, as well as for horticultural purposes. Recently too, a company has been established in Londonderry to use peat in the manufacture of activated carbon.[4] The most ambitious work is on the Altahullion bog, where a trial plot of 1300 acres is being worked by three cutting machines. A pilot plant is producing wax from the peat, and if this is commercially successful a larger factory for the purpose will be erected in Londonderry, where the waste peat left after extraction can be used for making activated carbon as well as for farming and horticulture.

But in all it is unlikely that over 20,000 tons of peat are used in any one year at the present.[5]

Even making allowance for the difficulties involved in exploiting Northern Ireland's turf and the limited nature of the deposits, Ulster's bogland still seems to have been less intensively exploited than in the Republic of Ireland. Admittedly most of the electricity generating stations there, designed to use peat fuel, are on large bogs suitable for machine working; but some are now being built which are designed to use hand-won peat.[6] Thus, although the physical nature of the peat resources largely explains the difference in the intensity of their use in the two countries, the industrial and economic structure of Northern Ireland also is relevant.

As Northern Ireland is part of the United Kingdom, its complete dependence on the British mainland for coal supplies is not a political problem, and forms a much less



Distribution and potential yield of exploitable bogs in Northern Ireland

severe economic difficulty than in the Republic. Admittedly the operation of the National Coal Board in the interests of the United Kingdom economy as a whole may not always correspond with the particular interests of consumers in Northern Ireland. It has been suggested, for example, that the post-war reorganization of the sources from which coal is supplied to the Northern Ireland market has resulted in an increase in the distance over which the coal is carried and in the handling which it undergoes, hence tending to increase coal prices and leading to the production of large quantities of slack.[7] But there is no balance of payments problem between Northern Ireland and Britain as they are part of the same economy, and the coal supply is dependable in that it does not have to be drawn from a foreign country. More particularly, coal is supplied to Northern Ireland at a much lower price than in the Republic where, on an average, English coal costs about £2 a ton more.

In any case, the difficulties inherent in importing coal have been present since the coming of modern industry to north-east Ireland in the nineteenth century, although they may now be somewhat more severe. Hence the manufacturing industries which have succeeded in Northern Ireland spend relatively little on fuel in relation to the cost of the finished product. In an industry like shipbuilding, for example, fuel costs in Northern Ireland amount to only 3·9 per cent. of the cost of the finished product, as compared with 2·9 per cent. in the shipbuilding industry of the United Kingdom as a whole.[8]

On the other hand, if cheap electricity was widely available, the pull on most new industry, which is exerted by Belfast and its immediate district,[9] might be reduced; but it would not be removed. Owing to the small local market a large part of the attraction of the port would remain, since the greater proportion of most products have to be exported, if only to Great Britain; and a whole-hearted policy of reviving decaying towns in the more remote parts of Ulster would involve an impossibly large direct subsidy, as no tariff protection is possible between Northern Ireland and Great Britain, both for political and economic reasons. In any case peat will not provide this cheap electricity. In the Republic of Ireland it is slightly cheaper to produce electricity from peat fuel than from coal or oil, but this would not be possible in Northern Ireland where the mechanical cutting of peat is so much more difficult. The notable increase in the consumption of fuel oil in the six counties may point to a more satisfactory solution,[10] while the significance of atomic power as a source of electricity remains to be explored. Certainly the promise of an atomic-powered generating station in Northern Ireland, on a site still to be decided, may mark a permanent solution to the fuel problems of the country; but whether it will help greatly in solving the unemployment problem is a debatable point, since only in part is this a product of costly fuel.

NOTES

[1] McCarthy, A. J. P., "The Irish National Electrification Scheme," *Geog. Rev.*, **47** (1957), pp. 539–54; D. J. Dwyer, "Peat fuel production in the Irish Republic," *Geography*, **42** (1958), pp. 126–8; D. J. Dwyer, "Utilization of the Irish peat bogs," *Geog. Rev.*, **48** (1958), pp. 572–3; T. W. Freeman, "Electricity from peat in Ireland," *Geogr. J.*, **122** (1956), pp. 135–6.

[2] For an account, see Isles and Cuthbert, 'An Economic Survey of Northern Ireland,' Belfast, H.M.S.O., 1957, p. 143.

[3] Council of Scientific Research and Development, 'The Northern Ireland Peat Bog Survey,' Belfast, H.M.S.O., 1956.

[4] 'Who makes what in Northern Ireland,' Belfast, H.M.S.O., 1957.

[5] A rough estimate made from figures supplied by various firms.

[6] McCarthy, *op. cit.*, p. 549.

[7] Sinclair, R., "Changing sources of coal for Northern Ireland," *Northwestern University Studies in Geography, Number* 2. Evanston, 1957, pp. 103–11.

[8] Isles and Cuthbert, *op. cit.*, p. 280.

[9] Of the 29,157 jobs created in Northern Ireland with government assistance between 1945 and the end of 1955, 14,178 were in Belfast and district; see, 'Ulster Year Book, 1956,' Belfast, H.M.S.O., 1956, p. 119.

[10] Consumption of oil fuel increased from 43 million gallons in 1951 to 67 million gallons in 1955.

A PLUVIAL AGE IN THE PUNA DE ATACAMA

C. VITA-FINZI

THE PUNA DE ATACAMA, which Bowman has described admirably,[1] is an area of basins, mountain knots and piedmont alluvial deposits at an elevation of about 10,000 feet, lying partly in Chile, Argentina and Bolivia, roughly between latitudes 26° and 18° S. The eastern marches of the Chilean Atacama Desert consist of a number of lofty depressions which are physiographically more akin to the Puna than to the low-lying coastal desert.

Few geological features are easier to identify than old shorelines in a desert basin,[2] and they have been seen in the Puna by various workers[3–6] who have ascribed them to high lake levels of a bygone pluvial period. In Bolivia, Moon[7] filled his lakes Balliván (Titicaca-Poopó) and Minchin with meltwater released by a Pleistocene interglacial. Newell[8] saw a gradual desiccation of the Titicaca region since a pluvial period in the late Pliocene and early Pleistocene. Brüggen[9] said the same of northern Chile; and Ahlfeld[10] extended one of his pluvial lakes from Bolivia into the adjacent Chilean basin of Ascotán. Other writers[11] have deduced from the archaeological record and certain natural phenomena, such as buried forests, a progressive desiccation of the Puna and the Desert of Atacama during the last few centuries.

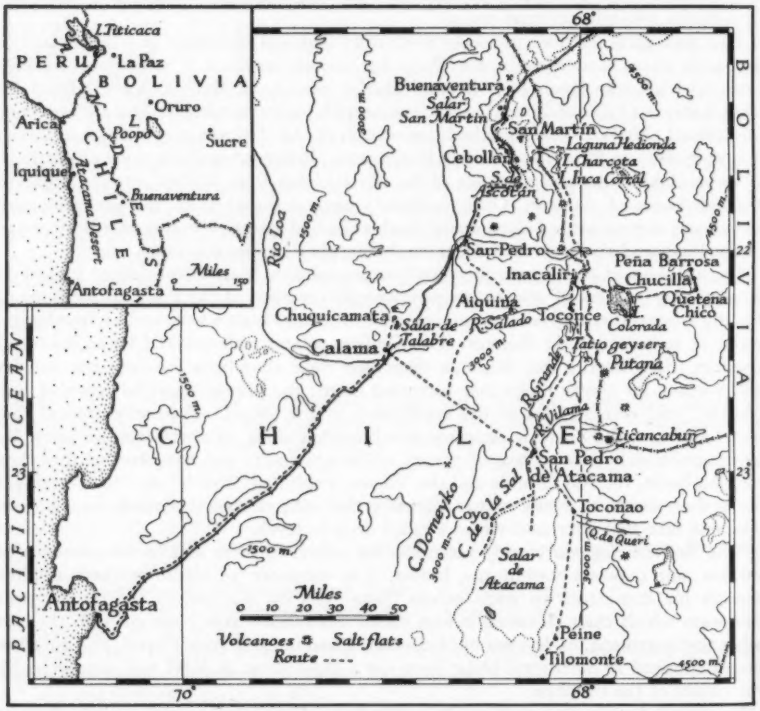
During August and September 1958 an expedition from Cambridge[12] looked at eight of the "salt lakes" that figure prominently on maps of the Puna, in the hope of finding around them physiographic evidence of former high levels, and archaeological proof of recent climatic changes. The Chilean *salares* (salt-covered basin floors) of Ascotán, San Martín and Atacama displayed clear shorelines cut into the usually soft volcanic or clayey rocks that surround them; the phrase "parallel roads of San Martín" will give an idea of the appearance of the shoreline stairway around that *salar*. Further, the Salar de Atacama was bounded along its north-western shore by an extensive delta-like terrace of gravel, cobbles and silt; and two streams that flow into the basin, the Rio Grande and the Vilama, exhibited "strath" and "cut" terraces along their courses, whose nature suggests that they formerly flowed into a deep Atacama lake that later underwent a rapid drop in level.

The Bolivian *lagunas* closely resemble the *salares* in form and in the presence of various salt deposits within the basins. The presence of shallow lakes—shallow enough for flamingoes to wade across them—can be ascribed to the greater precipitation which their elevation brings them. Shorelines have been cut into the soft ashes that surround the *lagunas* of Hedionda, Charcota and Inca Corral, and tufa has been deposited in horizontal beds; here too a rapid drop in level was suggested by the nature of the beaches.

Laguna Colorada displayed no clear shorelines. Rudolph[13] reported a fall of 3 feet in the lake level over the last twenty years, but stone polygons and archaeological finds just above the water level suggest that this drop was part of a short-term fluctuation rather than the coda of a secular shrinkage. The same writer cites evidence for a decrease in the rainfall of the Cordillera and, paradoxically, an increase in the humidity of the lower desert around Chuquicamata. The present writer witnessed the opening of the first real meteorological station in the Chilean section, at San Pedro de Atacama; it is too early to study recent climatic trends, but the large-scale, long-term changes have left clear traces in the deposits on the lake floors as well as around their margins.

Archaeologists like Boman[14] have seen in abandoned cultivation terraces and vanished or buried forests a change in climate. All the phenomena of this nature which were examined in the field could be explained adequately by isolated changes,

such as a falling water table in volcanic tuffs (and hence the disappearance of springs), drifting sand (buried forests), and the coming of the Spaniards (abandoned fields and terraces). The area proved spectacularly rich in archaeological sites; numerous "Atacameño" remains were discovered. Stone implements and potsherds, rock drawings, stone ruins (both Inca and pre-Inca), burials, and many other traces of human occupation occurred in the Desert and in the Puna. Of particular relevance to the palaeoclimatic study of the area was the distribution of the Stone Age sites in relation to the hypothetical former levels of the *lagunas* and *salares*: there seemed to be a typological sequence associated with the shores of progressively shrinking lakes. It is hoped that further study of material collected will confirm this tentative sequence. Archaeological study of the region is just beginning, since it is marginal to the more



spectacular Andean cultures, but it promises rich rewards in this as well as in the geographic field.

Besides surveying and mapping the beaches and archaeological sites, the expedition collected geological specimens for the British Museum, and much material for the Cambridge Museum of Archaeology and Ethnology. Weather observations and minor economic and ethnographic studies were also made. A colour film and numerous photographs supplement the written records.

The expedition, whose patron was the Duke of Edinburgh, was approved by the Council of the Society, and received financial support from many bodies, including the Mount Everest Foundation, the Worts Fund, Cambridge, and the Pilgrim Trust.

REFERENCES

[1] Bowman, I., "Desert trails of Atacama." *Spec. Publ. Amer. geogr. Soc.*, No. 5, 1924. See also H. Mortensen. 'Der Formenschatz der nordchilenischen Wüste,' Berlin, 1927.

[2] Deevey, J., "Palaeoclimatology," in 'Climatic change,' ed. by H. Shapley, Harvard, 1953.

[3] James, Preston E., "Iquique and the Atacama Desert," *Scot. geogr. Mag.* **43** (1927) pp. 205, 209.

[4] Bowman, I., *op. cit.*, p. 311. See also Captain B. Hall, 'South America,' Edinburgh, 1824, vol. 7, p. 8.

[5] Brüggen, J., 'Fundamentos de la geología de Chile,' Santiago, 1950, pp. 149, 213–14.

[6] Charlesworth, J. K., 'The Quaternary Era,' London, 1957, p. 1122.

[7] Moon, H. P., "The geology and physiography of the Altiplano of Peru and Bolivia," *Trans. Linn. Soc. Lond.* (3), **1** (1939) pp. 27–43.

[8] Newell, N. D., "The geology of the Titicaca region," *Mem. Geol. Soc. Amer.*, No. 36, 1949, p. 17.

[9] Brüggen, J., *op. cit.*, p. 213.

[10] Ahlfeld, F., "Geología de Bolivia," *Rev. Mus. Plata.* (*Arg.*) (n.s.) **3**, p. 19.

[11] Boman, Eric, 'Antiquités de la région Andine de la République Argentine et du désert d'Atacama,' Paris, 1908, p. 715; G. Mostny, "Ciudades Atacameñas," *Bol. Mus. nac. Hist. nat., Santiago*, **24** (1948) pp. 125–211.

[12] Cambridge Atacama Desert Expedition 1958: J. J. E. Aarons (St. John's College), surveyor; L. H. Barfield (Magdalene), archaeologist; C. A. Haysom (Downing), quartermaster; C. Vita-Finzi (St. John's College), leader, physiographer.

[13] Rudolph, W. E., "Chuquicamata twenty years after," *Geogr. Rev.* **41** (1951) p. 108.

[14] Boman, Eric, *op. cit.*

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING extract is taken from Sir Roderick Murchison's Presidential Address for 1859, given at the Annual Meeting on May 23 of that year. It is to be found in the *Journal of the Royal Geographical Society*, Vol. 29, pp. ccxxi–ccxxiii.

". . . Whilst a true '*esprit du corps*' has animated us on all occasions, never did it shine forth in a manner so congenial to my feelings as when the mass of the Society rose to bid farewell to my dear friend Livingstone, and at a few days' notice filled to repletion the largest festive hall of this metropolis to wish all success to the undaunted traveller who was about to reexplore the interior of South Africa.

"So steadily have our numbers augmented, that although the Society seemed to have reached its climax last year, when I spoke of its having rapidly increased from 600 to nearly 1100 members, I have now the happiness to know that it actually possesses 1200 members, a number far exceeding that of any other scientific body in London.

"Looking to the composition of this body, I rejoice to observe that it is made up of men of so influential and yet of such very different classes and walks in life as to ensure a long continuation of prosperity. In addition to the efforts of geographers, including eminent astronomers and physical philosophers, as well as ardent explorers of distant lands, this Association also flourishes through the good will and hearty support of statesmen, members of both Houses of Parliament, officers of the army and navy, residents in our colonies, and the merchant-traders of this great metropolis. All these, as well as many proprietors and professional gentlemen, take a deep interest in our progress, because they see and feel that in the diffusion of fresh knowledge, and in grappling with questions of physical geography, natural history, and the productions of distant countries, we are continually advancing the material interests of the nation.

"It is for such reasons that the Secretaries of the Foreign and Colonial Departments, as well as the Board of Admiralty, never fail to supply us with materials which sustain the interest and character of our evening meetings.

"Considering that a larger number of votaries attend these assemblies than those of any other scientific Society, the only drawback which seems to weigh upon us at the present moment is the difficulty of obtaining a meeting-room capacious enough to receive our great numbers. For the last two years the Council of the Royal Society and the Senate of the University of London have kindly permitted us to hold our meetings in the great hall at Burlington House; but if that room and all the beautiful adjacent buildings are to be removed in order to give place to colossal edifices, in which the cultivators of art and science are to have their meeting-places, galleries, and museums, let us confidently hope that a Society so useful and so popular as our own will receive some share of the patronage of the Government. . . . .

"I must here express my sincere satisfaction, that one of the results to which I have looked with deep interest for many years has been attained since I last addressed you. We have obtained a Royal Charter, which secures to us all those claims upon the State to which our works had already well entitled us; and, as we are now placed in precisely the same public condition as any of the older scientific Societies of the metropolis, it enables me with truth to take leave of my dear friends, as the really good 'Fellows of the Royal Geographical Society.' The use of my name as your President in this Royal Charter will indeed be to me a source of pleasing reflection through life, whilst it will acquaint those who follow us that I have been bound up with your rise and progress."

A FOUNDER OF MODERN GEOGRAPHY

ALEXANDER VON HUMBOLDT: Studien zu seiner universalen Geisteshaltung. Hrsg. von Joachim H. Schultze für die Gesellschaft für Erdkunde zu Berlin. *Berlin: W. de Gruyter*, 1959. 9½×7 *inches;* xxiv+277 *pages; plates and folding maps*

THIS VOLUME of essays was published, under the editorship of Professor J. H. Schultze, by the Berlin Geographical Society as part of the commemoration in May of the centenary of the death of Alexander von Humboldt. The work of Humboldt, as a "founder of modern geography," is generally appreciated in its main lines, and he is recognized as having inauguarated numerous studies related to geography which have developed into independent "earth sciences." The precise nature of these achievements, however, is not widely known in detail, and a number of essays in this volume elucidate or re-assess this for certain studies. Others portray Humboldt in some of the varied environments in which he worked during his long life. As with many volumes of this character, the final contents, for various reasons, are not as originally planned, but nevertheless they convey the unusual breadth and variety of Humboldt's interests. An important discovery—13 manuscript volumes, mainly Humboldt's travel journals—is briefly reported by Dr. Zúñiga.

Among the first category are chapters on his contribution to oceanography by Professor G. Wüst, to research in American prehistory by Dr. Neptali Zúñiga, and to political and economic geography through his essay "Essai politique sur le Royaume de la Nouvelle-Espagne" by Professor D. D. Brand. In a detailed study Professor E. Otremba examines Humboldt's account of the *llanos* of Venezuela in the light of his own observations in that region and finds much in the method of investigation to be still of value. He also examines how Humboldt came to regard the *llanos* as "authentic steppeland," contrary to the views of modern geographers. He considers this due in part to the conditions in which the journey was made, later changes in the use of the region, and the lack of certain data, such as rainfall figures. More unexpected are the chapters on his medical researches by Dr. H. Schipperges, and on his criticism of Spanish and Portuguese literature by Dr. H. Schneider. Among the second category of essays are those by Dr. E. F. Podach on Humboldt's relations with certain political and scientific circles in Paris, where he worked up the results of his great expedition to the New World, and by Dr. H. R. Friis on his visit to the United States when he was in close contact with President Jefferson at a time when exploration and scientific research was attracting much attention. Then there are the more general essays, on which much of what follows is based. Professor Schultze opens the volume with a succinct examination of Humboldt's intellectual and philosophical standing, Professor R. L. Stevens gives an excellent account of him as a scientific traveller and observer of nature, and Professor C. Troll contributes a final summary of Humboldt's scientific work.

A study of these essays shows that Humboldt's interests were even wider than is suggested by the subjects quoted above. From his observations on the vegetation zones while journeying through tropical America he established the elements of plant geography and devised the isotherm as an intrument for climatological research. His experiences among the volcanic zones of the earth led him to support the correct view in the current controversy over the physical characteristics of the earth's interior, and the unique range of his geological observations enabled him to demonstrate the similarity in character and position of rock strata in widely separated continents. Such work was of particular value at a time when geology was at a critical point in its development. Nor should his contribution to cartography be overlooked, not only

from the point of view of the mapping of South America, but in its development as an aid to other sciences.

In addition to being a critical and far-sighted observer, Humboldt possessed an unusual ability to formulate ideas and hypotheses. It was the astonishing content of his knowledge and the universality of his intellect which won him the admiration and friendship of men like Goethe. He was not the keen but indiscriminate observer; he was interested in those facts which bore in the widest sense on the relationship of living things to their physical environment, itself the result of the interplay of many factors, and it was by his advocacy and exposition of this principle that he made his decisive contribution to the development of geography.

Reviewing Humboldt's achievements briefly, it might be thought that to some extent he was fortunate in the times in which he lived. It is true that the Spanish possessions in the New World were under relatively liberal government during his visit. Had it been planned some years later, the revolutionary upheaval would have rendered such research impossible. Again, many of his studies in America depended to some degree on the work of recent predecessors, in cartography and the collection of statistics, for example. Only in the late eighteenth century could it have been possible to envisage work of so universal a character as that of Humboldt's. Some years later, the climate of scientific thought was entirely hostile to works of so all-embracing a character as his, and scientists confined themselves to their individual specialisms. In some respects Humboldt certainly was a product of the eighteenth century, but he also shared in establishing new trends in scientific thought, and in fact originated or inspired several of the "earth sciences" which developed so rapidly in the nineteenth century. In this connection, a brief consideration of the practical difficulties encountered by Humboldt and his companion Bonpland in their American travels will help to maintain perspective with regard to his achievements. There was, for example, the technique of travel in a strange and primitive country; then the tropical pests and diseases, of which little was known; the preservation and transport of their huge collection of specimens; the repair and replacement of instruments. It was largely their adaptability and ability to seize opportunities that brought them through.

The essay on Humboldt in the United States throws much light on his personality and character, and helps to explain the world-wide renown which came to him later. One observer noted "He was most truly a citizen of the world . . . in all climes, he recognized man as his brother—kind, frank, cordial in his disposition, expansive and enlightened in his views, his sympathies were never chilled—his opinions never warped by prejudice." To this may be added the tribute of Sir Roderick Murchison, fifty years later: "But it was not merely by his courtesy and correspondence that Humboldt won the affectionate attachment of mankind. He was invariably the ardent and disinterested promoter of merit and desert, under whatever forms they were presented to him. Every young man struggling with difficulties, who had shown signs of energy in the cause of science, was sure to find in him a zealous and generous protector."

G. R. CRONE

"THE LEAF OF THE WILD PLUM WHEN AUTUMN HAS COME": A GEOGRAPHY OF CHINA

A GEOGRAPHY OF CHINA (CHUNG-KUO TI-LI). By WANG CHUNG-CHI. Two volumes. *T'aipei: State Translation Office*, 1956. $8^{1}/_{4} \times 6$ *inches; 789 pages; maps, plates and diagrams*

IT IS ASTONISHING, and a matter for regret, that no British professional geographer is concerning himself seriously with the landscape of China. It is no less than astounding that the same should be true of the United States, so that the national territory of a quarter of the world's population is being ignored by English-speaking geographers and, indeed, by almost all Western geographers. In both Britain and America, good reasons can be adduced for this neglect of such a considerable portion of the earth's surface, but it is doubtful if the difficulties in the way of such studies are really insuperable. The Bamboo Curtain is no barrier—except to Americans—in the sense in which the Iron Curtain was and still, to a large extent, is. The Chinese Communist presses pour out an abundance of statistical information which is easily obtainable in the West and which, despite prevailing journalistic opinion, is not wholly unreliable. The Chinese require to communicate with other Communist societies by means of the written word quite as much as the countries of the Western world need to disseminate information among themselves. In any case, Chinese geographers are far from ignoring the works of their Western counterparts. Rather are they studying them with the thoroughness which characterizes all the undertakings of their regime. It is true that both the theory and practice of geography in the People's Republic of China are based on Russian models, so that, for example, physical and economic geography are regarded as the central themes. Moreover, the four regional monographs so far published by the reorganized Institute of Geography lean heavily on Russian techniques, and some papers in the leading geographical journal (*Ti-li Hsüeh-pao*) have been overly imitative of Russian models; but this probably does no more than reflect China's closer political ties with the Soviet Union than with the West, and the fact that in Russia geographical principles are being applied to the same types of problems as face the Chinese, that is, problems of regional and economic planning. In T'aiwan, on the other hand, geography is modelled on the Western, and particularly the American, pattern, as the numerous publications of the Institute of Agricultural Geography in T'aipei bear abundant witness.

In August 1953 the Editorial Board of the T'aiwan Ministry of Education's University Series (*Chiao-yü-pu Ta-hsüeh Yung-shu Pien-shen-hui*) commissioned the well-known scholar, Mr. Wang Chung-chi, alias Wang I-yai, to compile a geography of China. The result is a work which, apart from an occasional sentence such as that which compares the shape of Chinese territory to "the leaf of the wild plum when autumn has come" (p. 3), might well have been written by a Western geographer. In fact, these volumes have patently been modelled on the standard type of undergraduate text used in British and American universities.

Leaving on one side Theodore Shabad's comprehensive gazetteer, there are only two Western texts with which this work can be usefully compared, namely George B. Cressey's 'Land of the 500 million' and Professor Roxby's British Admiralty 'Handbook of China.' Mr. Wang's book is closer in conception to that of Professor Cressey, whom Wang mentions on several occasions with evident appreciation. The arrangement of the material is in the main conventional. Volume I deals with the systematic aspects of Chinese geography, with six chapters devoted to physical geography and

eleven to human geography, while Volume II consists of seven long sections of regional description. This arrangement has necessitated a certain amount of repetition, which Mr. Wang has commendably kept to a minimum by treating only of generalities in Volume I and retaining regional examples for Volume II. It is notable that the authorities quoted in the systematic sections are overwhelmingly Western, but in the regional chapters almost all Wang's information is drawn from Chinese writers or from his own observations.

The introductory account of the physical landscape is adequate by British standards. It is, in fact, more detailed than the parallel account in Professor Cressey's book, which was, however, written for American colleges, where a strong physical section is seldom considered desirable. In view of the lack of detailed studies of China's more mountainous districts, Wang's attempt at a genetic account of the morphology of China is a *tour de force* which should certainly be consulted by Western geographers who aspire to write on that country. Yet, it is no disparagement of Wang's technical expertise to admit that geomorphology in China is still in its infancy, and that it is more than doubtful if all Wang's conclusions will stand the test of time. The other chapters in this section deal respectively with climate, drainage and soils. A curious apparent omission here is any reference to natural vegetation, which later turns up anomalously in the section on human geography. I have been unable to discover what induced Mr. Wang to abandon the orthodox arrangement in this instance. The section on human geography begins with an apparently original study of the water resources of China, illustrated with several unusual maps, among them one of the irrigation regions of China. The chapter on agriculture is disappointing for it adds nothing to the work of J. Lossing Buck, published as long ago as 1937. Other aspects of the cultural landscape discussed in this section of the book include herding and fishing, mining, industry, communications, foreign trade, population, the Chinese abroad, and rural and urban settlement, in that order. The penultimate chapter incorporates the most informative map of the distribution of overseas Chinese that this reviewer has seen. Few parts of the world have not provided a livelihood for these resilient emigrants, but the rationale of their precise distribution is often difficult to discern. Why, for example, should there be more than four times as many Chinese in Saudi Arabia as in Great Britain? It is a pity that this map lacks a date, but there are some indications that it refers to the later years of the Republic. The map does not distinguish the several types of South Chinese—virtually all emigrants have been South Chinese—which is a pity, because it would have been interesting to see how the various dialectal groups have distributed themselves throughout the world. There is no map of, and very little information about, the provenance of these emigrants. The chapters on settlement are the weakest in the book. Such categories as "riverside village" are hardly illuminating and certainly not significant, and the whole settlement pattern is discussed descriptively as if it had suddenly been created by divine fiat in 1956. In this Wang has merely followed the majority of Western writers on Chinese geography, who, with the exception of Professor Roxby, have treated Chinese settlement patterns in the same fashion. Of the influence of *feng-shui* on the location of farm sites, of the effect of sinicization on the settlement patterns of aboriginal folk, of the progressive founding of *hsien* cities, of the basic plan of the Chinese town retained for well over two thousand years, of its division into functionally independent units welded into internal coherence by an enduring principle of north–south axiality, and of the numerous similar topics inherent in even the most elementary study of Chinese settlement patterns, this book makes no mention.

In Volume II Wang describes his seven main regional divisions of China, which he further divides into no less than twenty-eight sub-regions, each described in what, for an avowed textbook, is considerable detail. The scale of subdivision can be illustrated by Wang's treatment of the Central Region, which he partitions into the Yang-tzŭ delta, the Ch'ao-Chiao basin and the Wan-Che range, the P'o-yang basin, the basin of the Two Lakes, the Ch'in-ling Pa range, the Nan-Yang basin and the

Ssŭ-ch'uan basin. Each sub-region is illustrated with a detailed relief and general purpose map, often supplemented with other maps of local distributions. These chapters provide the most detailed description of Chinese landscapes at present available in book form.

Not the least interesting feature of these volumes to the Western geographer is Wang's rendering of technical terminology. By any standard Chinese is an inconvenient medium for this purpose. The genius of the language, with its predilection for suggestion rather than affirmation, is alien to precision. Although Wang's nomenclature is without exception borrowed from Western geography, his terminology is coined on two principles, namely transliteration and translation, both of which can be illustrated from the suite of terms used to describe the limestone terrains of Kuei-chou and Kuang-hsi. The phrase "karst topography" is rendered by the first method as *k'a-szŭ-t'e* topography, a form which would seem to offer little advantage compared with some simple *translation* such as *shih-hui* or limestone topography. The terms used by Wang for the unit forms which go to make up this genus of landscape are in fact mainly translations, of which the following examples are representative.

doline	hui-ching (limestone pit)
ponor	lo-shui tung (cave of falling water)
uvala	hui-wa (limestone hollow)
polje	hui-p'en (limestone basin)
hum	hui-yen ts'an-ch'iu (cliffed residual hillock in limestone)

The Chinese phrase used by Wang to denote "clints" or "lapiés" or "schratten" or whatever one is to call them in the West is metaphor rather than direct translation, for it can be rendered literally as "stone forest" (*shih lin*). All these terms are clear enough in the Chinese once the reader has been alerted to the tenor and implications of the text, though it must be admitted that, as the poverty of sounds in the Chinese language makes it an unusually imperfect instrument for reproducing foreign words, translations are at first reading almost invariably more readily recognized than transliterations. It is worthy of note that Wang chose to use these foreign terms rather than draw on the rich store of regional names for limestone features which characterize the dialects of South and West China. That the karsts of these districts have entered deeply into the fabric of Chinese provincial life is attested by such famous tales as that of the White Monkey in the *T'ai-p'ing Kuang-chi*.

The extent to which other technical terms have been borrowed from Western geography is evident from the selected examples in the appendix. Generally speaking, proper names in European languages appear as transliterations in the Chinese. Other terms are all either translations or paraphrases of European expressions, though the paraphrases often incorporate concepts implicit in, but not specifically expressed by, the original European forms. The paraphrase for "peneplain" is a good example. In rendering this term as "a plain newly developed at a succeeding level," the idea of a surface approaching the condition of a plain is abandoned for a circumlocutory rendering of the genetic process.

These two volumes are illustrated with 118 maps, diagrams and field sketches, and Mr. Wang is to be congratulated on the excellence of their conception and execution. But the publishers must be censured for the execrable way in which the blocks have been reproduced. The definition of page after page of these maps is so poor as to discourage the fastidious reader from consulting them at all, yet their content is often well worth the effort. Beyond the fuzz and blotch is a mine of information not otherwise easily available in summary form. It goes without saying that, when the line blocks are mutilated in this fashion, the half-tone reproductions will be at best indistinct. Some, such as that of the Ta-pa Shan erosion surface (Fig. 43), for example, are wholly illegible. Incidentally it should be noted that Figures 137 and 138 have their captions reversed.

Despite the quantity of information contained in these 789 pages—possibly the equivalent of some 250,000 words in a European language—the chief interest of Wang's work resides in his methodology as it reflects trends in Nationalist Chinese geographical practice. From this point of view the chief criticism that can be levelled at the book is its complete rejection of the evolutionary aspects of the Chinese cultural landscape in favour of contemporary descriptive analysis. This seems to me at all times to be an unnecessary limitation, but is particularly unfortunate when writing about one of the oldest and most complex landscapes on the face of the earth. Any account of the settlement pattern of South China which, for example, fails to take account of the slow processes of conquest, sinicization and migration by which that region has been incorporated in the Chinese polity can be little more than a parody. The reader will look in vain for any reference to the *t'un-t'ien* system of agricultural colonization which has left its permanent imprint on the map of China in place-names incorporating the element *kuan* or "official"; *e.g.* Kuan-t'ung, meaning an official reservation, Kuan-t'ien, referring to government fields, and many others. Neither does Wang attempt to assess the relative contributions of cultural factors and the physical environment in creating the several distinctive South-Chinese farming landscapes. These examples must suffice to indicate Wang's approach to the human landscape, and it is in this respect that his work differs most noticeably from that of Professor Roxby, whose constant endeavour it was to write of the Chinese landscape in its historical perspective. Roxby's command of both the Chinese language and its source materials was inadequate for the carrying out of his design, but his book does bear the imprint of a mind sincerely striving to explain, not merely describe. On closing the Admiralty 'Handbook' the reader is left with the impression that had Professor Roxby acquired mastery of the Chinese language, or possibly had he lived longer, he would have done for China what thirty years earlier he had achieved, on a smaller scale, for East Anglia, namely an interpretation of the present-day landscape in terms of its traditional provincial life. For Mr. Wang, on the other hand, the landscape is a static entity. He has no thought for the past and allows himself only a perfunctory glance to the future. But this synoptic approach obscures the essential quality of landscape as a continually changing entity which can be adequately studied only in its totality, in time as well as in space.

The second major deficiency of Wang's book derives from his deliberate refusal to take account of the changing political framework. Both T'aiwan and the mainland are treated as if they comprised a single political unit, and I have found in the whole work not a single reference to the stupendous happenings of the last decade in the People's Republic of China, where an entirely new landscape is being created by the controlled application of the world's largest labour force. This alarming attitude, I suspect, stems from two sources. In the first place, the book has clearly been influenced by certain Western texts which adopt this attitude and, in the second, this is probably the only exposition acceptable to the T'aiwan Ministry of Education. Nevertheless, to this reviewer it is regrettable that the book should have been thus emasculated.

These criticisms do not wholly invalidate the value of Mr. Wang's carefully marshalled survey as a store of basic information on the geography of China. And, as he points out in his modest preface, the author laboured under handicaps, not the least of which was the difficulty of obtaining reference works. Under the circumstances it is surprising that he achieved so much.

Appendix: Examples of geographical terms used

Hercynian orogeny	Hai-hsi-ning yün-tung (transliteration)
Neo-Cathaysian geosyncline	Hsin-hua-hsia ta-nei-hsia (translation)
Cycle of erosion	ti-hsing hsün-huan (=morphological cycle)
Erosion surface	ch'in-shih mien (translation)

Peneplain	hsin-sheng tai-chun p'ing-mien (=plain newly developed at a succeeding level)
Monadnock	ch'in-shih p'ing-yüan-shang-ti ts'an-ch'iu (=residual hillock on a plain of erosion)
Floodplain	fan-lan ch'ung-chi p'ing-yüan (=plain of flood alluvium)
Subsequent stream	hou-ch'eng ho (=stream which develops later—an unfortunate rendering which suggests that Wang is ignorant of the true nature of such streams)
Cuesta	tan-mien shan (=hill of plain surface)
Tombolo	lu-lien tao (land-linked island)
Mean annual rainfall variability	nien-p'ing-chün pien-lü (translation)
Humid microthermal climate	liang-wen shih-jun chi-hou (translation)
Tropical evergreen broadleaf forest	je-tai ch'ang-lu k'uo-yeh lin-tai (translation)
Agglomerated settlement	Chi-chü hsing (translation)
Regionalism	Chü-yü-hsing (translation)

PAUL WHEATLEY

AN ECONOMIC GEOGRAPHY OF "NORDEN"

AN ECONOMIC GEOGRAPHY OF THE SCANDINAVIAN COUNTRIES AND FINLAND. By W. R. MEAD. *London: University of London Press*, 1958. 9½×7 *inches;* xvi+302 *pages; maps, diagrams, plates.* 42*s*

THE SUDDEN profusion of books about the Northern countries, by O'Dell,[1] Chabot[2] and Mead, is perhaps a coincidence, but all the same it is very useful to have these publications at hand on the eve of the International Geographical Congress of 1960, to give authoritative and up-to-date information about the area to participants from abroad. To a far greater extent than the two other authors Dr. Mead treats the five countries as a whole, in the same way as they are to be joint hosts to the Congress—although the meetings will be mostly in Stockholm.

Like Professor Chabot, Dr. Mead defines the scope of his book as "the Scandinavian States and Finland," and within this concept he includes both Iceland and Greenland. To a Scandinavian, it is rather surprising to encounter a delimitation which means that more than 60 per cent. of the area of Scandinavia is situated in North America—the part of the world within which we have hitherto been accustomed to include Greenland. The concept "Scandinavia," as used by us, does not even comprise Iceland and the Faeroes, although their people speak languages belonging to the "Scandinavian language family."

The author discusses the problem of nomenclature, and informs us that "within the borders of the five countries, the collective name *Norden* is used freely; but it is unsatisfactory for world currency." I welcome this opportunity to suggest that the name "Norden" is *not* "unsatisfactory for world currency," and that it be adopted for international use, at least among professional geographers. "Norden" has a precise and well-established meaning: namely, Scandinavia (Denmark, Norway and Sweden), Finland, the Faeroes and Iceland. It must be inconvenient for Anglo-Saxons to write about "Scandinavia and Finland," and unsatisfactory too, as the reader can never be

[1] O'Dell, Andrew C., 'The Scandinavian world,' London, 1957.

[2] Chabot, Georges, 'L'Europe du nord et du nord-ouest,' Tome II: 'Finlande et pays scandinaves,' Paris, 1958.

sure exactly which area is meant. The different constituents of "Norden" have so many things in common, and these common factors are so continually increasing, that the need for a short collective name is very real, for international as well as internal use. Svalbard and Jan Mayen may then be treated as appendices to "Norden," and Greenland as a country wholly apart although belonging to the Kingdom of Denmark.

"Economists of the northern world have played with corporate phrases of a Benelux character; but the least euphonistically offensive—Uniscan—has yet to gain more than limited circulation. In any case, it refers only to three of the five states under consideration." Thus Dr. Mead on page 6: the last statement is correct, but Uniscan includes a fourth country, the *Uni*ted Kingdom. It belongs to the abbreviation-flora brought forth by post-war international economic cooperation, and is no alternative to "Norden"!

Dr. Mead's book is the result of many years of interest in "Norden," of travel there, and of cultivation of connections in all the countries concerned. He has mastered the Scandinavian languages as well as Finnish, and this must be of inestimable value to him in his researches. It is not difficult to read Danish, Norwegian and Swedish when you know one of these languages, but it is not always easy to discern between the correct spelling used in each language for words more or less common to all of them. Into this trap Dr. Mead—who sprinkles his text liberally with Scandinavian and Finnish terms—often falls, and sometimes forgets that some letters are used only in some of the languages—for instance, ö and ä in Swedish and Finnish, ø and æ in Danish and Norwegian: Vest-Ägder is not only a wrong, but an impossible, spelling of the name of the Norwegian *fylke* Vest-Agder.

The reviewer finds no reason for retaining archaic forms like fiord (Danish and Norwegian fjord); but he does, on the other hand, fully sympathize with foreigners who find it difficult to keep abreast with all innovations in spelling, especially as far as Norway is concerned. Of more general interest, is the rendering of names of rivers, lakes, etc. Here we find the same river indiscriminately labelled Ume älv, Ume river and Ume. The last form is not to be recommended, but what really is the merit in translating part of the name, a procedure which must be very difficult to apply consistently the world over? If one writes Lake Väner instead of [Lake] Vänern, one will have to write Lake Mjøs instead of [Lake] Mjøsa.

On the whole, a more restricted use of place-names would have added to the readability of the book, especially as many belong to little-known places and a considerable number are incorrectly written. Of nine places on the map on page 270, five are spelled wrongly. Kongeåen was partly on the Dano-German boundary from 1864 to 1920, but today there is no reason to use the German name Königsau—and even less the hybrid Königsaaen.

Dr. Mead's book makes an attractive impression by its unorthodox approach, and it is stimulating reading, for the author subscribes to the principle of letting his "enthusiasm assert itself where it has been kindled by particular topics or places, believing that what a writer enjoys writing some readers at least will enjoy reading." As an example may be mentioned the chapter entitled "Setting, resources and short-term physical variations," which is better characterized by the simple sub-title "A geography of winter." By words, figures, graphs and maps Dr. Mead succeeds in drawing a striking picture of the impact of winter cold, snow and ice and the way in which this challenge is met by man. Maps show the times during which certain Baltic ports and Norwegian highways are closed to traffic, tables show the snow obstruction and clearance costs on roads and Sweden's total "winter bill." The author's compliments to Northern refinements in heat conservation are heartily endorsed by the reviewer who, born north of the Arctic Circle, never felt more miserable from cold than during a winter's stay in London. When the author mentions the snow accumulation maps compiled yearly by the meteorological services, he ought to have added that they are prepared first and foremost as an aid to the management of hydro-electric plants, in which connection they are used in fore-

casting river-flow. The use made of this information by road administration and other authorities is wholly incidental.

The emphasis laid on certain characteristic activities and phenomena means that other things have to be skimmed over. The ample treatment of Swedish mining, metallurgy and softwood industries leaves little room for other branches of industry, even for the textile industry with its interesting cotton mill location in the Swedish "Lancashire," the Borås area. An appendix of tables, or perhaps a chapter on foreign trade, giving in table form the composition of each country's exports and imports, would have done much to redress the balance.

Geography text-books often carry a heavy load of out-dated information. Dr. Mead's book, based to a great extent on personal contact and thorough knowledge of contributions by Northern geographers, suffers comparatively little from this. It may be pointed out, however, that, while it was true to say before the war that merely a third of the population of northern Norway was supplied with electricity as compared with 80 per cent. for the country as a whole, the corresponding 1957 figures were 87 per cent. and 97 per cent.

Dr. Mead writes precisely and succinctly, but occasionally the reader gets a perplexed feeling that his own pedestrian mind is helpless in trying to follow the flight of the author's. A case is on page 186: "Nor is it difficult to imagine that the Finnish steam-bath or *sauna* is a logical aftermath of woodland burning." It would be unjust to accuse Dr. Mead of determinism and it is perhaps unavoidable that in dealing with a part of the world where nature-control is so conspicuous, primitive determinism may sometimes raise its head. The fact that death rates from tuberculosis in northern Norway are double those in southern Norway tells us next to nothing about the effect of the "maldistribution of sunshine" in the north, as long as this part of the country is in such an unfavourable position with regard to its standard of living and the availability of medical services. To the same class of statements belong: "Consciousness of the need for population remains strong in contemporary Scandinavia, and in its northern parts the philosophy of numbers is much upheld" (p. 83). It is true that birth-rates are high in the north, but if there is any philosophy behind this fact it is that of laissez-faire!

The section on "The Lapp world" makes interesting reading because of the ample treatment of the problems of adaptation to a modern technical and commercial way of life. The open-minded and liberal attitude of Swedish authorities is well stated, but differences in official policy between Sweden and Norway might well have been stressed, especially in regard to earlier practice. The problems are complicated by the sordid fact that germs of racial prejudice may spread even in cold climates, although Finnmark is, of course, no Rhodesia. When the population of the three rural districts in Finnmark with an overwhelming Lappish population increased by 71 per cent. during 1931–56—more than four times as much as in Norway as a whole—this was in the first instance due to great natural increase; but secondly also to the fact that a psychological barrier operates against migration from the area although its economic basis becomes more and more insufficient by national standards.

The above criticisms are part of a long list of notes. This is perhaps the price which must be paid by an author who has the courage to approach a big and heterogeneous area instead of restraining his activities within a narrow field of specialization. Anyway, few of the mishaps are of the kind that really impair the context, and most are of the type that is not easily avoided in a presentation loaded with facts and details. Dr. Mead has gone a long way towards realizing the interacting human and natural facts that gives this area a distinct geographical identity in spite of numerous inner contrasts. Both he and the English-reading public are to be congratulated.

HALLSTEIN MYKLEBOST

A HISTORY OF THE PATHANS

THE PATHANS. By Sir Olaf Caroe. *London: Macmillan*, 1958. 8½ × 5½ *inches; 522 pages; maps and plates.* 60*s*

It is astonishing that we have had to wait so long for a history of the Pathans. To the West the Persian bibliography is immense; whilst every facet of life on the Indian sub-continent has been covered in many thousands of volumes. In contrast, between Persia and the Indus, we have been content to tolerate a vacuum in history. It is as if the doubts and dangers of the unknown valleys behind the hills astride the Khyber Pass which for years baffled the British-Indian administration had by the same token paralysed the historians. The gap has now been filled; and Sir Olaf Caroe, with that eye for immense detail with which we associate his work, has given us the story of the border tribes in unrestricted historical profusion.

My mind went back to the days when for two or three years I had roamed about the Safed Koh range with the Turis of the Kurram valley; and I could have wished that this book had then been available for our guidance as officers of the Frontier Corps. The official text books provided us with the local details down to the last family subdivision of tribal loyalty. But there was a need for something which would give us the picture as a whole. Without a common focus we developed our local loyalties to Wazir, Mahsud, Turi, Orakzai and so on, often in heated controversy and competition.

Sir Olaf first assures us that the Pathans, so far from being the wanderers of legend, are of Eastern Iranian stock, the Iranian atmosphere which today prevails around Peshawar being attributed to influences long before the coming of Islam. For many without the benefits of the academic approach, the distant past, as told by the author, will be noted mainly for the extremely clear account of the peregrinations of the tourist warrior, Alexander of Macedon. I can well remember the sudden interest which always revived whenever Aurel Stein was back again in the north of India looking around, and the controversy which lingered on as to Alexander's exact route as he emerged into the Kabul river valley at Mardan and struck east to the Indus. A short narrative of his course with a map and the extent and nature of the subsequent limited influence of his pretorian, Seleucus, has not yet been presented in a clear and concentrated account; and we are grateful for the attention now given to this brief and fascinating corner of history.

Our reliance on Sir Olaf's conclusions are confirmed when we become aware of the great care lavished in sifting the merits of the various sources of information. Strabo, Ptolemy and Herodotus all contributed. But it is Arrian on whom Sir Olaf leans for the greater share in his conclusions; and he gives us his reasons. While drawing attention to the similarity of the features in profile of a modern Pathan militiaman and Alexander the Great, we are given no encouragement regarding the factual evidence of an admixture of Greek blood in Afridis or anyone else.

Readers will, according to their inclination, turn to those pages which represent their personal interest. The obscure early centuries of the first Christian millennium will not necessarily attract Englishmen looking for conditions as they existed when the first British contacts were established west of the Indus. By 1750 the astonishing Ahmad Shah of the new Afghan Durrani Dynasty had extended his territory from the Oxus to the Indus. By 1756 he was down to Delhi after defeating the Sikhs and having annexed Kashmir in 1752. There followed a protracted struggle for supremacy between Sikhs and Afghans, Ahmad Shah returning the Central Punjab to his enemies, but retaining control over North Punjab and Peshawar. By 1818 Ranjit Singh was firmly established between the Indus and the Sutlej and in 1837 his kingdom reached up to Peshawar.

Some years ago a pamphlet was available in the Afghan Embassy in London which

contained a map showing "Pakhtunistan" as occupying the whole of the North-west Frontier Province, which formerly included the Hazara District lying to the east of the Indus. "Pushtu is the language of the Pakhtunes: it is also spoken by the seven million inhabitants of Pakhtunistan between Afghanistan and Pakistan" was the comment in the text. Apart from the fact that the people referred to number about 2,400,000 and not 7,000,000, the point to note was that the geographical frontiers shown on the map were not incorrect. How many Englishmen who worked on the frontier were aware of the territorial conditions of two hundred years ago? Sir Olaf Caroe has rightly given prominence to the story of Afghan occupation in the Indus valley and some perspective is thus given to the subsequent Afghan political support for a Pathan state which would embrace all the territory from the Indus up to the Durand Line, the status of territory west of the line on Afghan soil being conveniently ignored.

Afghan domination of the Peshawar valley disappeared. Nevertheless the latter half of the last century saw the government in Kabul again feeling its way to the east. The Amir, Abdur Rahman, was seeking to establish authority in the tribal areas; and it was to clear up much obscurity and define the limits of Afghan ambition that in 1893 Sir Mortimer Durand was charged with the task of demarcating a boundary on the map in consultation with the Amir. After only a few weeks agreement was reached, each party accepting the obligation not to "exercise interference" in the territories of the other lying beyond the line and professing to regard the agreement as a "full and satisfactory settlement of all the principal differences of opinion which have arisen between them in regard to the frontier."

The obligation not to "exercise interference" was for years loosely interpreted by both Afghans and tribesmen. Nevertheless, Durand's line served its purpose; and at a time when the Afghans could have challenged the geographical frontier and raised the whole question of the tribal relationship, projecting the issue of Pakhtunistan into the controversy if they wished to do so, they withheld their claims.

That opportunity presented itself after the third Afghan War; and it is here that the author is curiously silent. The brief war of 1919 was, after all, a milestone in our relations with Afghanistan and I can think of no reason for its neglect in a history of the Pathans. A temporary treaty signed in Rawalpindi in 1919 was followed by the permanent Treaty signed in Kabul in 1921. So far from challenging the demarcation of Sir Mortimer Durand, Article 2 of the 1921 Treaty confirmed it. Confirmation was also inherent in the terms of the Article 11 which declared: "The two High Contracting parties having mutually satisfied themselves, each regarding their benevolent intentions towards the tribes residing close to their respective boundaries, hereby undertake each to inform the other in future military operations of major importance which may appear necessary for the maintenance of order among the frontier tribes residing within their respective sphere before the commencement of such operations."

This agreement seems so directly to concern the affairs of the frontier tribes that it hardly seems logical in so complete a compilation to find no references to so important a phase in their history. In contrast, we pass over the years and find a very clear account of a development which constantly puzzled students of the Indian scene from a distance, namely the paradox of a strong Moslem group in the North-west Frontier Province, the Red Shirts, in close sympathy and alliance with the Indian National Congress. In an area which was essentially Moslem, the status of Moslems, as such, could never have been challenged. Without the need for the protection of the Moslem League, nationalism of the Indian complexion and a sense of politics could flourish and claim the sympathy and energies of many eager young Moslems, for whom the appeal of a Moslem State as the alternative to Hindu domination from Delhi was never a reality. Such a movement, isolated from India and surrounded by Pakistan, could never have maintained its separate identity; and its eventual support of the concept of "Pakhtunistan" could be regarded as a last gesture of despair.

All this is covered with close attention by Sir Olaf Caroe and the story carries

authority in our knowledge that he himself was close to events at the time. It is thus that we are rewarded with some deft and analytical sketches of the main characters on the stage during this particular phase: the polished Dr. Khan Sahib, his less enlightened but likeable brother, Khan Abdul Ghaffar Khan and that grand figure, the father of frontier statesmen, Nawab Sahibzada Sir Abdulquayyum. There will be many readers who will recall with affection his rival, the Falstaffian and boisterous Nawab of Hoti, whose enormous voice for years boomed through the corridors of the Legislative Assembly in Delhi. Akbar of Hoti had little political acumen; but he was a dear friend to the Englishmen of his generation and he is not forgotten by Sir Olaf.

Of the short list of Englishmen who controlled the new Frontier Province onwards from 1901, Sir Harold Deane and Sir George Roos-Keppel are rightly given prominence. The personality of Roos-Keppel was so unusual that it is curious that his fame never reached beyond the frontiers and the people among whom he built up his unique position. Sir Olaf makes no attempt to hide the seamy side of an arresting character. Results were achieved which could compare with the highest traditions of Empire pioneering. But they emerged in a most un-English way.

The author leaves us in little doubt as to the man he himself would select as meriting the first place among the pioneers. "The righteousness of an Edwardes, the flamboyance of a Cavagnari, the cold grey eye of a Roos-Keppel, seem crude and insignificant beside the instinctive grasp, the deep humanism of Mountstuart Elphinstone." With affection we are reminded of the scope and achievement of an Englishman who had exerted his steady influence on events just 100 years before Roos-Keppel took control. Elphinstone's task as Envoy to Shah Shuja, with Rangit Singh's ambitious eye in the Punjab turning towards Kashmir, was not enviable. But more arresting than the political moves at the time is the light thrown on Elphinstone as a personality in his descriptions of nature and humanity around the bazaars and gardens of Peshawar and Kohat. I may be forgiven for a personal interest in this particular passage, since the Kohat Pass over which Elphinstone required a full escort for a safe passage, was the scene of much dispute in the 1920's, when I found myself under the orders of that gallant man, Mr. E. C. Handyside, searching the Bosti Khel villages for those responsible for the kidnapping of Miss Molly Ellis; and I was grateful to the author for the care with which he recalled the event.

We could have expected some mild elaboration of the work of the High Commissioners who followed Roos-Keppel. In particular, the firm hand of Sir John Maffey—now Lord Rugby—could in my view have received recognition. There are some other omissions. We are taken as far as the partition of the Indian sub-continent in August, 1947. Discretion and the desire to avoid the modern political labyrinth which surrounds the Kashmir problem may have decided the author to leave the part played by Pathans in Kashmir in 1947 untouched. Research into the irresponsible adventures of a few Wana Wazirs, Mohmands, Swatis and Bunerwals who, in that fateful October, passed through Abbottabad in trucks and entered Kashmir territory at Domel, might not be desirable at this particular stage in Indian-Pakistani relationships. Nevertheless, the history of the Pathans cannot be complete without it.

It remains only to pay a tribute to the striking efficiency with which Sir Olaf's research has been presented. I am not sure that I like the method of concentrating footnotes in a collective group at the end of the book. But that is a matter of personal taste. For the rest, clear printing, smooth paper, excellent illustrations and maps and scholarly annotation combine to present a great work, written in the great manner.

BIRDWOOD

REVIEWS

EUROPE

THE PRINTED MAPS OF WARWICKSHIRE, 1576–1900. By P. D. A. HARVEY and HARRY THORPE. *Warwick: Records and Museum Committee, Warwickshire County Council, in collaboration with the University of Birmingham*, 1959. $9\frac{1}{2} \times 7$ *inches;* xii + 280 *pages; illustrations.* 30*s*

This well produced volume is the result of cooperation between an archivist and a historical geographer. Mr. P. D. A. Harvey has compiled with great care a catalogue of the printed maps of Warwickshire from that of Christopher Saxton to the close of the nineteenth century. He includes those which give details within the county boundary only, and also combined maps of not more than two counties in all. The Ordnance Survey sheets, beginning with the first One Inch sheet containing part of Warwickshire, 1828, are placed in a supplementary list, as some series fall outside this definition. Mr. Harvey has traced numerous editions of maps published in the nineteenth century in small county atlases, guide books and similar ephemeral publications, some in as many as a dozen editions, or amended "lithographic transfers." Locations of the maps are not given, but a few annotated copies of the catalogue are being prepared, one of which is to be deposited in the Map Room of the British Museum.

The introduction by Dr. Thorpe, reader in historical geography in the University of Birmingham, gives a critical account of the progress of the mapping of Warwickshire, the development in the representation of its geographical characteristics, the methods employed by the surveyors, with some evaluation of the reliability of the data contained in them, *e.g.* a list of railways authorized and shown on Warwickshire maps but never actually built.

Apart from the "national cartographers," such as Saxton and Speed, dealt with by Dr. Thorpe, two local cartographers are of special importance, Sir William Dugdale and Henry Beighton. Dugdale's map, which is probably based on his own surveys, appeared with his 'Antiquities' in 1656. On the scale of three miles to one inch, it incorporates a good deal of antiquarian detail, including "depopulated places." The representation of the roads, however, shows little advance, being based mainly on the anonymous map of *c.* 1603, which in its turn, it is suggested, may derive from a map by John Norden.

Henry Beighton, a Fellow of the Royal Society and a man of many interests, has not previously received much attention, but Dr. Thorpe has rectified this by a detailed and appreciative account of his work. His map, 1728, was the first large-scale map of the county—one inch to one mile—and the first to be based on a carefully thought out system of triangulation. It greatly influenced subsequent maps until the predominance of the Ordnance Survey sheets. The instruments he employed are illustrated in an inset: they include a graphometer, with two pairs of open sights; a plane-table with box compass attached, of his own design; a "curious Way-wiser" or perambulator for measuring distances; and, apparently, a telescopic alidade. Among other detail, he mapped installations associated with milling, mining and metal working. The map does not appear to have met with great financial success, largely owing to delays in its publication through difficulties with the engravers, and copies are rare. A second edition with some additions, also rare, was published by his widow in 1750. One weak feature of all the early maps was the representation of relief, and this was not finally remedied until the introduction of contours at the end of the nineteenth century. Dr. Thorpe has treated a number of topics in a very readable manner, and his introduction will be of interest not only to students of Warwickshire maps, but to all interested in county cartography. The volume contains twelve half-tone reproductions of portions of important maps, but not including Beighton's one-inch map.

G. R. CRONE

THE ART OF NAVIGATION IN ENGLAND IN ELIZABETHAN AND EARLY STUART TIMES. By DAVID W. WATERS. With a foreword by Admiral of the Fleet the Earl Mountbatten of Burma. *London: Hollis and Carter*, 1958. 10×6 *inches;* xl+696 *pages; plates, diagrams, appendices.* 84*s*

This is a very elaborate text-book on a subject which Commander Waters has studied with great care, neglecting no source which seemed to him able to increase his knowledge. He has built up a bibliography of early books on navigation as used by the ship-masters and pilots of European seafaring nations and has shown how much the later English writers owed to their foreign predecessors. But Commander Waters has not been content with studying the early text-books, for he has read the surviving journals of early voyages which have enabled him to compare practice with precept. He has searched for examples of early navigational instruments and subjected them to a scrutiny which had enabled him to describe their construction and uses. He has thus reconstructed and described for us the contemporary scene at sea in some detail. This then is a book which no serious student of the subject will be able to neglect for many years to come. The appendices contain a useful collection of pertinent extracts from rare books. Many readers may think the most valuable original contribution by the author is his explanation of a seaman's understanding and use of mathematics in the sixteenth century. The seaman's use of scales as a short cut in working out his problems is carefully analysed. These aids appear today in the well-known books of navigational tables and nautical almanacks. The story told is of the victory of modern mathematics over the older rule of thumb methods which died hard, or are still dying. This love of sometimes almost unnecessary precision was early noticed as the hall-mark of certain English seamen, the scholars trained under Wright and Davis and other teachers of precise navigation. Sir Jonas Moore's 'A new system of mathematicks,' published in 1681, discusses the various methods used to discover the distance run by the seamen of various nations, including the Spaniards, Portuguese and Dutch: "But the most approved way and now most followed, is by our English log and log line." Commander Waters interprets the scope of his subject perhaps too liberally. He describes the preparations made for a sea voyage, the build, rig and performance of the ships, and adds for good measure biographies of distinguished seamen. We have material to fill several books crammed between two covers. And the author must be most heartily congratulated on having combined so much so instructively and entertainingly. The many plates of illustrations and the diagrams in the text, all carefully explained and described, form a text-book of note in themselves, perhaps rather divorced from the main text. But it is very useful to have so many illustrations together under one roof, so to speak. Perhaps in the second edition which is bound to be called for, the plates 53 and 70, from articles in the National Maritime Museum, might be more clearly linked together. For the ivory forestaff, backstaff and scales, by Thomas Tuttell of Charing Cross, in about 1690, were obtained in new condition, packed together as a set in one case. It is of course obvious that the back-staff could only be used with the sun on bright days and must be assisted by some other instrument of direct observation, in this case the forestaff. In preparing this most comprehensive and scholarly book on a difficult subject, Commander Waters has shown himself a most worthy disciple of Professor E. G. R. Taylor, whose masterly history of navigation, 'The haven-finding art,' was published by the same firm in 1956.

G. P. B. NAISH

RURAL DEPOPULATION IN ENGLAND AND WALES, 1851–1951. By JOHN SAVILLE; and THE COUNTRY CRAFTSMAN. By W. M. WILLIAMS. Dartington Hall Studies in Rural Sociology. *London: Routledge and Kegan Paul*, 1957 *and* 1958. 8¾×5½ *inches;* 254 *and* 214 *pages; maps and text figures.* 28*s* and 25*s*

The objects of the Dartington Hall Trust at Totnes in Devon are described by L. K. Elmhirst, its chairman, as not only the undertaking of "practical experiments in rural reconstruction, embracing education and the arts as well as agriculture and industry,

but also to promote research into rural life." Some of the results of this research have been published in a variety of books, but the Trustees have now decided to sponsor a series of social studies on rural problems. The first of these new books is a study of rural depopulation in England and Wales during the last hundred years. The author first provides the historical background of the growth of the predominantly urban society in England and Wales. He attributes the rapid expansion of towns in the nineteenth century partly to the high rate of natural increase of the urban population, but also to the continuous inflow of people from the rural areas. A third factor was immigration into England and Wales from Scotland and especially from Ireland. Mr. Saville shows that the exodus from the countryside has continued during the twentieth century, but at a slower rate.

Not the least valuable part of Mr. Saville's research is that concerned with the sex balance in rural areas. He produces surprising figures which prove that economic and social developments since the end of the nineteenth century have combined to drive women out of the countryside into the towns at a greater rate than men. While in England and Wales as a whole the surplus of females over males is still considerable, in the rural areas there are fewer women than men, and under the age of fifty the difference is very great. He also argues that the decline in rural population has been greater than is usually recognized, and that normally the more rural the area, the greater has been the decline. The author combines his generalizations with detailed accounts of rural depopulation in Rutland and Warwickshire, and makes an even longer study of the South Hams, a group of eighteen parishes in south Devon. His study of the South Hams strengthens his general conclusion that "in the absence of positive action, rural depopulation and social decay will continue." The book is well documented and it is satisfactory to notice that the works of many British geographers are cited; for example, the author describes some of J. W. House's interesting essays as "pioneering contributions" to a neglected field of study.

The first requirement to check rural depopulation is to provide more jobs for people who would like to live in the country and have no inclination towards farming as a career. W. M. Williams's account of the country craftsman is therefore a natural sequel to the first volume in the series. He examines the decline of three rural crafts, saddlery, thatching and farriery, as trades which are unsuited to extensive technical change and then considers blacksmithing, agricultural engineering and wheelwrighting which are more easily modernized. He devotes a chapter to potters, weavers and furniture makers who endeavour to sell their products in a national market. He makes detailed studies, with maps, of the geographical distribution of craftsmen and their service areas, both in Devon and in Staffordshire, Shropshire and Cheshire which he oddly describes as the West Midlands. The author appears to undervalue the achievements of the Rural Community Councils, and does not deal quite fairly with the majority report of the Scott Committee on Land Utilization in Rural Areas. All will agree with his plea for more research on rural problems. E. W. GILBERT

THE RHONDDA VALLEYS: a study in industrial development, 1800 to the present day. By E. D. LEWIS. *London: Phoenix House*, 1959. $9\frac{3}{4} \times 6\frac{1}{2}$ *inches; 312 pages; maps and plates.* 25*s*

In 1955, approximately one hundred years after the proved discovery of steam coal seams had started the Rhonddas on their period of spectacular economic growth, these industrial settlements, which had been an Urban District since 1895, received incorporation as a Municipal Borough. Partly to mark this change in status, the Borough undertook the publication of a book on its history, and the result is this handsomely produced volume from the pen of a man who, like so many of his generation, was given a university education by his miner father.

The book is an expansion from an M.A. dissertation on 'The industrial development of the Rhondda Valleys to 1910' submitted in History. Though its core is therefore a study in economic history, the author has considerably broadened the scope of the

work so as to convert it from an academic thesis to a book of more general interest and appeal. This expansion applies to time as well as to subject matter, for the last chapter is devoted to the industrial pattern of the Rhonddas from 1914 to the present day.

After two introductory chapters respectively on the physical background and on the social and agrarian conditions in the Rhondda in the pre-industrial era, the author goes on to deal with the economic history, first of bituminous, and later of steam coal exploitation. The developments from Walter Coffin's first "level" in 1809 to the great amalgamations and horizontal combinations such as the Cambrian Combine and the Ocean Company which characterized the Rhonddas from 1884 to 1914 are treated in a manner which, combining scholarship with ease of expression, is eminently readable.

There follow a number of chapters on specific topics, some economic, such as transport and markets, and some on the more sociological aspects of labour relations, social conditions, population and language. This part of the book does not appear to be quite as successful, for it is rather uneven in its standard, and is not always as well ordered as it might be. Thus there are two chapters on the 'Life of the people," one covering the period before the great expansion of steam coal exploitation, and one from 1860 to 1914. These tend to be rather heterogeneous in content, ranging from education and price fluctuations to the provision of services such as gas and water. Moreover the break at 1860, though it is fully justified, is not followed in the chapter on population and immigration, where it was surely even more critical. It is in these chapters, possibly, that the transition from academic dissertation to general history becomes a little rough, and it might have been better to have taken topics such as education, public utilities, cost of living, etc. and followed their development throughout the whole period of industrial growth. The sections on population, immigration and language are likewise not up to the standard of the first part of the book.

As might be expected in any history of the Rhondda, labour relations play a very important part, and they receive full treatment up to 1914 in a special chapter. Like the chapters on the economic history, this is well written, although perhaps not always as dispassionate as it might be. The book concludes with a chapter on the changing industrial face of the Rhondda consequent upon the introduction of light industry, and both here and elsewhere there are some useful and attractively clear maps. In summary, this work is a very useful economic history of what is, to the human geographer, one of the most individual and fascinating of Britain's industrial regions. Both the author and the sponsoring Rhondda Council are to be congratulated on a project which might well be copied by other local authorities in South Wales and elsewhere.

J. G. THOMAS

THE GREAT TIDE: the story of the 1953 flood disaster in Essex. By HILDA GRIEVE. Maps drawn by P. A. Starke. *Chelmsford: County Council of Essex*, 1959. $9\frac{3}{4}\times7$ *inches;* 883 *pages; maps and plates.* 30*s*

CANVEY ISLAND: the history of a marshland community. By BASIL CRACKNELL. Department of English Local History, University of Leicester, Occasional Papers No. 12. *Leicester University Press*, 1959. $9\frac{3}{4}\times7$ *inches;* 47 *pages; maps and diagrams.* 12*s*

ESSEX AND THE SEA. Compiled by K. NEWTON. Essex Record Publications No. 31. *Chelmsford*, 1959. $9\frac{1}{2}\times6$ *inches; not paginated* (48 *pages*); 42 *maps, illustrations, plates.* 25 6*d*

All three of these publications are concerned with Essex and the sea, but the resemblance ends there. 'The great tide,' by Hilda Grieve, published by the Essex County Council, is an authoritative history of the great floods of 1953. It is conceived and executed along epic lines, as befits the subject with which it is concerned. Vast quantities of source material from technical reports to the hurried jottings made of telephone conversations on that disastrous night of 31 January 1953 have been

collected, sifted and weighed during the indefatigable searches of Miss Grieve, who has walked more than 900 miles over the Essex coast observing, recording and verifying innumerable details. The result is not only a vivid, gripping and sympathetic narrative of the hour-by-hour and day-to-day events of those days, but also an extremely interesting and perceptive synthesis, valuable for its exposition of the problems of sea defence in the past as well as the present and for its clear presentation, in non-technical language, of such germane matters as the genesis of the great tide or the problems involved in the recovery of farm land from damage by sea water. The contrasts in the course of events and in the problems of Harwich, Jaywick, Canvey and Tilbury are strikingly illustrated.

Above all, however, Miss Grieve has contributed a detailed and incisive study of ordinary people's reactions to unexpected crisis. The stories of many anonymous individuals, families and officials contribute much at a personal level, but from the early reluctance to recognize the extent of danger to the time of resettlement, repair and rebuilding, it is the administrative problems which often arouse the greatest interest. Rules and red tape were willingly subordinated to the major aim of giving succour and relieving suffering. Problems of organization were overcome so often by individuals acting sensibly on their own responsibility that defects of administrative organization mattered much less than they might have done.

The Essex County Council is to be congratulated, not only on its execution of the decision made in March 1953, "that reports should be obtained from all sources with a view to recording in book form the complete story of the flood disaster in Essex and the steps taken to deal with it," but also on its choice of author. The criticisms that one can make of the book, that it is too long, and at certain points repetitious, are perhaps inevitably bound up with its character as an official history.

By the side of 'The great tide,' the history of the marshland communities of Canvey Island may seem rather arid and stilted. The author insists that this is the history of communities and not the history of a place and may therefore be forgiven for his uncritical acceptance of the idea of a sudden and catastrophic submergence of the island in the second century A.D. One would have liked a more critical appreciation, with a more intensive search for local evidence, of the idea of a Saxo-Norman emergence, which is accepted for Canvey Island almost entirely on the basis of the Yarmouth evidence. To a geographer, however, it is the peculiarly difficult problems presented by the place itself which constitute a common theme running through the histories of its people. The chief phases in Canvey's history are briefly portrayed. The medieval and Tudor function of Canvey as a sheep pasture for mainland villages (reflected in the confusion of parish boundaries) and as a producer of strong-flavoured ewe-milk cheese for London markets was followed by the most interesting period of Canvey's history in which reclamation and dyke building were closely associated with Dutch enterprise and Dutch immigrant farmers, who retained identity as a separate community until the end of the seventeenth century. Long after they had disappeared as a community, the burden of taxes for the repair of walls continued to fall on the lands they had held, so that urban development in the twentieth century in its avoidance of these lands and its preference for the "freelands" still reflects a pattern created in the seventeenth century.

'Essex and the sea,' is a short booklet written to accompany one of those annual exhibitions of documents, maps and other material which in recent years have been such an extremely interesting and rewarding feature of the Essex Record Office. A brief introduction outlines the main themes in the relations of Essex with the sea—the defence of the coast against invaders and the sea itself, the rise and fall of small coastal ports, fishing and the oyster industry, coastal industries including the collection of copperas, salt making and ship and boat building, and the rise of the seaside resorts. This account, though brief, is informative, succinct and stimulating, and serves admirably to introduce the forty-two excellently chosen photographs, maps and plans, prints and reproductions of documents which follow. Much is to be learnt from the

illustrations and the captions to them about such diverse topics as the importance of smuggling in the eighteenth century, or the origin of Clacton-on-Sea. C. T. SMITH

L'EUROPE. By MAX DERRUAU. *Paris: Hachette*, 1958. 9×5½ *inches;* 604 *pages; maps and photographs.* 2700 *frs*

Europe is here selected as one unit in the "Les cinq parties du monde" series, which seeks to portray the post-war world to non-specialist readers. As M. Derruau notes (p. 383), "Europe" is variously taken to include 20, 17, 15, 13 or even only 6 countries; here, however, he surveys Europe in the large and includes the whole of the U.S.S.R.

After a short introductory section devoted to the physical background and settlement of the whole continent, the treatment is regional. Each country is described and they are grouped under general heads: the Mediterranean peninsulas; the islands and peninsulas of the north and north-west; "the North-west façade"—this consists of France, Germany, Switzerland, Austria and the Low Countries; Central Europe, Slav and Danubian, *i.e.* the so-called People's Republics; and lastly the U.S.S.R. Significant of developments during the last ten years is the need now to include a chapter (Chapter 15) on "Projects and institutions in western Europe" explaining the creation and organization of O.E.E.C., E.P.U., E.C.S.C., the Common Market and the Council of Europe. Derruau makes clear that the eventual aim of the six states which have combined to form the European Coal and Steel Community and the Common Market is political integration; hence the disinclination of the United Kingdom, interested in no more than coordination, to throw in its lot with these functional bodies controlled by supra-national authorities. The book ends with a short conclusion in which M. Derruau asks, but does not answer, the question "Can we speak of the decline of Europe?"

'L'Europe' presents systematically accurate and up-to-date summaries of the essential geographical facts from which emerge outline sketches of each country—of its land, people, economic development and problems. Doubtless the author has dealt more briefly with certain parts of the continent than with others: thus Part V which describes the seven People's Republics is shorter than Part I, that on the three Mediterranean peninsulas. A generous selection of maps (some in colour) and of photographs ranges widely and effectively illustrates the physical and human geography of our complicated continent. W. GORDON EAST

LO STUDIO DELLE AREE DI MERCATO IN ITALIA. By GUGLIELMO TAGLIACARNE. *Milan: A. Giuffre*, 1957. 9½×6¾ *inches;* 97 *pages;* 36 *maps.* 1200 *lire*

The study of human "community of interest" areas, otherwise known as urban hinterlands, spheres of influence, service areas, market areas, "umlands," etc., has been pursued in recent years by a variety of people who, starting from different points of approach, are often unaware of the work of others in the field. Geographers have done something to collect together contributions to this "fringe subject," and the present study by G. Tagliacarne provides an introduction to what is being done in Italy. Apparently the first of a series to be entitled 'Quaderni dell'Associazione Italiana per gli Studi di Mercati,' this booklet is in two parts: the first a discussion of "objects, criteria, and methods for the delimitation of market areas," and the second an account of recent work in Italy. This has taken various forms, including both higher degree theses and studies sponsored by Chambers of Commerce and the like.

The first part suggests that only in the United States has any significant work taken place, and that Professor W. F. Reilly of Texas alone has made any important theoretical studies. Certainly more practical use has been made of such studies by commercial interests in the United States than elsewhere, but Tagliacarne would have given more weight to his plea for increased research in Italy had he shown more awareness of progress in this field since the formulation of "Reilly's Law." He postulates three phases in the determination of market areas: (i) determining which are the urban centres on which a sphere of purchasing power centres; (ii) the theoretical

delimitation of this sphere with the aid of some generally available data; and (iii) "control" of theory by investigations on the spot, and personal interviews. So far so good, but clearly the author has scarcely begun to consider the existence of towns and hinterlands of different orders of importance and, apart from a description of A. Piatier's work on the French department of Loire et Cher, one could be led to imagine that towns differed only quantitatively, not qualitatively.

Because of the lack of clear conception of different "orders" of town and hinterland it is not made plain that both parts of the book deal only with towns as "fourth order" or district centres. Nevertheless, the studies summarized in Part 2 are a useful source of data on community of interest areas in Italy, and it is to be hoped that the gaps between the areas studied will be filled in; one can see a map emerging which is generally similar to the maps of "fourth order" centres in Britain and in other north European countries. The spacing of centres is similar, apparently dominated by time and distance more than by density of population, though there is some indication that parts of southern Italy differ from the north in rather the same way as the Republic of Ireland differs from the United Kingdom; that is, urban centres are less well developed.

The author seems particularly concerned with how far Italian administrative "provinces" coincide with the market areas of their head towns. As in the French departments, the coincidence is fairly good, in marked contrast with British counties; local taxation systems in Italy, however, make this of more practical commercial importance than in this country. Tagliacarne draws attention to the use which can be made of the varying receipts from the "imposta communale di consumo" in making a quantitative classification of towns. It will be interesting to see what other volumes appear in this series of 'Quaderni.'

F. H. W. GREEN

THE ISLAND OF ELBA: a report of geographical field-work carried out during April 1958 by The Geographical Field Group. *Nottingham University*, 1959. $9\frac{3}{4}\times8$ *inches;* 113 *pages;* 30 *maps in colour.* 5*s* (6*s to non-members*)

A small island is an ideal geographical unit for field-work, and everything of importance in Elba appears to have been covered in this report produced by the Geographical Field Group. The report is primarily for the use of those participating in the fortnight's course, and the authors are to be congratulated on having provided such a comprehensive volume, not an easy task when it comes to writing something up after returning home.

The complicated geology and geomorphology of the island are covered adequately enough to form a background to the human geography, while the climate, understandably, has been described from records collected mainly at one meteorological station. On the human side the description of a number of farms is particularly useful, while full attention has been given to the nature of the settlements in the island, and one can gain some impression of the contrast between nucleated and dispersed types in Italy as a whole. The history of the island is brought in where relevant, while the growing importance of tourism is stressed and a note is included on voting trends.

In spite of certain small drawbacks and the excessive length of some sections, the report makes a useful supplement to a general text-book on Italy and, even for someone who has not visited Elba, makes entertaining reading, though the implication that the island can be used as a model for the whole of peninsular Italy certainly overestimates the range of its physical and human geography, varied though they are.

J. P. COLE

DIE NEUAUSLOTUNG DES CHIEMSEEBECKENS. By FRIEDRICH WILHELM. Münchner Geographische Hefte 15. *München: Geogr. Inst. der Tech. Hochschule*, 1958. $9\frac{1}{4}\times6\frac{1}{2}$ *inches;* 50 *pages; map, plates, text-figures.* DM.5

Considerable uncertainty has long existed regarding the submarine morphology of the Chiemsee, the largest lake in the Bavarian Alps. Previous surveys provided conflicting results which, in their turn, gave rise to different theories concerning its mode

of origin. This book describes the latest and most comprehensive survey undertaken by the late Dr. F. Zorell and students of the department of geography, Munich University, between July 1952 and September 1953. The methods adopted in making this re-survey are described in great detail and there follows an elaborate discussion of theories concerning the likely mode of formation of the Chiemsee.

Accurate positioning of the plumbing points within the 80·1 sq. kilometre lake was a major problem. In the cold winter of 1928–9 Reissinger was able to make precisely-positioned soundings of part of the centre of the lake from the ice which had formed over it. Otherwise the earlier surveys had had to rely on a variety of unreliable methods as, for instance, the numbers of oar strokes rowed between soundings relative to fixed objects onshore. Results obtained in this way were consequently of doubtful accuracy. In the present survey the plumbing points were fixed by the use of two theodolites in conjunction with an elaborate system of optical signals to enable synchronization of depth–time–position readings. Over short distances tachymetry was employed, together with a simple method involving a floating line ranged between shore and fixed buoy.

Results based on over 6000 soundings are expressed cartographically, on a scale of 1 : 25,000, by means of submarine contours or isohypses, rather than by isobaths. Broadly the lake is divided into two parts on the basis of underwater morphology, a main portion in the east, and a smaller portion in the west which contains three islands. Extensive north–south furrows, about 450 metres above sea level, separated by narrow ridges 500 metres or so above sea level, characterize the eastern portion. The smaller portion south of the Herreninsel (largest island) appears to be occupied by a pronounced platform seamed with east–west furrows. It is suggested that the ridges represent medial moraines and drumlins (and these are known to rest on eroded sandstone) and the furrows the courses of tongues of the Chiemsee glacier when it moved out from the Alps during the Würm phase of the Pleistocene glaciation. No evidence was forthcoming in support of the re-subsidence theory of L. Simon (1920) or the theory of isostatic readjustment put forward by O. Ganss (1955 and 1956).

Zorell died before the results of the survey were fully interpreted and the present account is the work of Dr. Friedrich Wilhelm. The book contains information of undoubted interest to students of Alpine glaciology and geomorphology and at the same time provides a valuable guide to procedural methods for future bathymetric surveys.

G. MELVYN HOWE

KLIMATOGRAPHIE VON ÖSTERREICH. Edited and published, with the aid of various contributors, by F. STEINHAUSER, O. ECKEL and F. LAUSCHER. *Vienna: Österr. Akad. der Wiss., Denkschr. der Gesamtakad., Bd.* 3, 1 *Lief*, 1958. 12×8 *inches;* 136 *pages*; *maps, diagr. and tables*

The contents of this number are arranged in three parts: "Geographische Grundlagen," by F. Hader; "Das Strahlungsklima," by F. Stauberer and I. Dirmhirn; "Sonnenschein," by F. Steinhauser. The first part discusses the interesting geographical position of Austria in the heart of Europe, as affected by various meteorological factors. The second deals with the radiation climate whose importance is becoming more and more realized, especially in relation to living creatures. It includes direct solar radiation, sky radiation, and intensity of light, showing how these are affected by slope and aspect, nature of terrain and cities. Naturally in a mountainous country like Austria slopes are of fundamental significance. Thus a table on page 33 indicates that a vertical south wall receives only 33 per cent. of the total radiation in summer, but as much as 400 per cent. in winter.

The third part comprises the distribution of sunshine as determined by length of day and meteorological factors, expressed as a percentage of the possible amount. Whereas during the winter months from November to February Vienna is much less sunny than the Sonnblick, some 10,000 feet up in the Hohe Tauern, the reverse holds from March to September. In the winter the Alpine regions rise clear of the low-

land fogs, but in spring and summer convection produces much cloud and precipitation on the peaks.

In four detached coloured maps of the seasonal distribution of sunshine over the country it may, perhaps, be assumed that the division follows the usual convention among meteorologists of including June, July and August as summer, December, January and February as winter, etc. This, however, should have been so stated since in the previous part on the radiation climate it is made quite clear that summer means May, June and July, when the days are longest, and winter November, December and January, when they are shortest. The discrepancy, of course, arises from the phenomenon of thermal lag after the solstices which plays so great a part in climatology but is often insufficiently stressed.

It is a pity that so thorough and excellent a compilation should suffer from a perplexing bibliography. Thus there is nothing to indicate where this issue stands in relation to other aspects of the climate of Austria including temperature, rainfall and wind. Nor is it at all clear to what "Band 3, 1 Lieferung" refers!

L. C. W. BONACINA

LES PAYSAGES AGRAIRES. By A. MEYNIER. *Paris: Armand Colin*, 1958. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches; 199 pages; maps and diagrams. No price*

French scholars have made notable contributions to the study of rural landscapes. The historical studies of Bloch and the geographical researches of Dion are of fundamental importance. To the notable colloquium 'Structures agraires et paysages ruraux,' which Professor Meynier helped to edit in 1957, there is now added this more popular summary.

This short work is divided into three parts, dealing respectively with the distribution of the major types of rural landscape, the factors affecting their formation, and the major problems in the study of these landscapes. In view of the literature available, it is understandable that over two-thirds of the book is concerned with European landscapes, notably those of France and to a less extent Germany. Apart from the uneven quality of literature available which influences this emphasis, it might perhaps have been better to concentrate only on the European landscapes, as the treatment elsewhere is unsatisfactory, random samples not helping a systematic presentation. Moreover, despite the output of data concerning Scandinavia, Northern Europe is not well treated and the scantier data on the Mediterranean lands have not been used carefully. There is a useful bibliography but it has been rather loosely collated. In view of the numerous references to local names for field units and practices, a glossary of terms would be a welcome addition in any subsequent edition.

But these are only minor criticisms to an authoritative work, well conceived, clearly presented and providing a succinct synthesis of a complex subject. Section two of the book is particularly useful for the student, and in the third section there is an excellent summary of the features of enclosed and open field landscapes. This is a work which is indispensable to the student of social geography. J. M. HOUSTON

ASIA

REPORT OF THE LAND COMMISSION, GOVERNMENT OF CEYLON. Sessional Paper X. *Colombo:* 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 234 pages; folding land utilization map of Ceylon, 24 miles to one inch* (1957). *Rs.* 6.20

In July 1955 the Governor-General of Ceylon appointed a commission of six members with wide terms of reference, but broadly to enquire into and report on the land laws of Ceylon and to make recommendations to secure the more efficient use of the land resources of the country. Two members were added shortly after the Commission began work, one being B. H. Farmer of the department of geography of the University of Cambridge whose book, 'Pioneer peasant colonization in Ceylon,' has much of the material fundamental to the understanding of the present position. The

Commission issued an interim report; its final report is a lengthy document which touches in one way or another upon almost every aspect of life in rural Ceylon. The Commission carried out its task with great thoroughness, held sittings in most parts of the island, and made study tours in India, Pakistan, Malaya and Indonesia. There is accordingly an immense amount of material in the report, but it is not easy to read. The land laws and customs and their consequences are familiar to the Commissioners but not easy for the outsider to follow. There are repeated references to the interim report and, although many vernacular words are explained, the reader is presumed to know the character and composition of a *kachcherie* and the precise meaning of *chena* and the implications of the system.

In general terms all land to which private ownership cannot be proved is presumed to be Crown Land—state-owned. This includes all land which has been subject to shifting cultivation. Alienation of Crown Land or grants of land for development have been made upon satisfactory evidence of intention and ability to develop. Clearly such applications are more easily made by corporations for tea, rubber or other plantation crops than by individual peasants or by villagers wishing to extend village lands. Obviously too the whole position is now changed by the rapid increase in population and the extensive reclamation works being undertaken. What strikes one most about the numerous recommendations in the report is their universal application. A dozen countries might be quoted where similar reforms are advised or in hand. More adequate surveys, registration of title, nation-wide planning of land use (under a Natural Resources Planning Unit), a balanced allotment of land between the various desirable uses and classes of user (including conservation of wild life), the prevention of fragmentation, the provision of assistance, the dissemination of agricultural information and the improvement of roads are but some. At a time when the betterment clauses in the 1947 Town Planning Act of Britain have proved a failure and been repealed it is interesting to see a Betterment Tax proposed—details to be worked out. Also the report envisages the continued existence of such classes of society as "middle-class," "lower middle-class," "educated youth" and "peasants"—but in most respects the recommendations are those being made in many other countries.

L. Dudley Stamp

LONGHOUSE AND JUNGLE: an expedition to Sarawak. By Guy Arnold. *London: Chatto and Windus*, 1959. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 206 *pages; maps, plan, plates.* 21*s*

WORLD WITHIN: A BORNEO STORY. By Tom Harrisson. *London: Cresset Press*, 1959. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+349 *pages; maps, plates.* 30*s*

With the support of our Society four young Oxford graduates, an anthropologist, a zoologist, a geologist, and a forester, set out to explore the almost unknown Usun Apau plateau in eastern Sarawak. From their base camp at the junction of the Menapun and Plieran rivers they each went their several ways, and this is the journal of the leader and anthropologist. It is eminently readable and gives an excellent picture of the country, the account of the ascent of Mt. Batu Bora being particularly interesting, since little has been recorded about Bornean terrain above the limit of heavy forest. But in some ways the book is disappointing, quite apart from such slips as the reference to a gibbon's tail (p. 80). The author concentrated his anthropological researches on the nomadic Penans, but the chapter devoted to them is chatty rather than informative. The references, too, to the zoological specimens collected are tantalizingly vague and at least a brief account of the scientific results achieved by the other members of the expedition would have been welcome. The maps are informative and not overcrowded, but there is no index.

Mr. Arnold only gives one chapter to the Kelabits; it is with this remarkable racial group that Mr. Harrisson's book is chiefly concerned. In 1944, when the tide had clearly turned against the Japanese, a plan was initiated by the author, and finally approved after many difficulties and much wrangling, to harass the enemy by infiltration, not from the strongly held and difficult coast of Borneo, but from the

interior, whence they would be least likely to expect attack. For this it was essential to find open, level country suitable for the dropping of personnel and supplies and fertile enough to provide local food. Only the upland irrigated valleys of the unexplored Kelabit country on both sides of the Sarawak–Dutch Borneo boundary fulfilled the necessary conditions, and how the author, on the slenderest evidence, located the area and rightly guessed the type of ground he would hit, and the sort of reception he would get when landing by parachute, is only one of the enthralling stories interwoven in his narrative. The first third of the book consists of a masterly description of the Kelabits as they were before the war and the consequent impact of civilization altered their way of life for ever. The author was the first white man to return to Japanese-held Borneo and, between his description when he touched earth, or rather mud, and his first look round, he interposes another flash-back of his earlier life and the formation of "Z" Special Unit to which he was attached. Then comes the first meeting with the local inhabitants, the quick establishment of friendly relations, the setting up of radio communication, the collection of stores and finally the arming and training of the tribesmen ready for action when the Australians landed on the coast in force. From then onwards the various detachments of "Z" Special Unit carried out a series of entirely successful guerrilla operations, inflicting heavy casualties on the bewildered enemy floundering in heavy jungle. Finally, there is the disbanding of the unit and the attendant problems. It is good to know that the author of this remarkable book is living in Sarawak, guiding the tribes he loves along the difficult paths of peace.

The maps, specially made with the assistance of our Society and essential for following the course of events, are models of clarity. The illustrations are good and the index is full.

J. P. MILLS

ANGKOR. By MALCOLM MACDONALD, with one hundred and twelve photographs by Loke Wan Tho and the author. *London: Jonathan Cape*, 1958. $9\frac{1}{4} \times 6\frac{3}{4}$ *inches; 158 pages; sketch map and illustrations.* 42*s*

In the course of his travels as Commissioner-General for South-east Asia Mr. MacDonald has acquired a remarkable first-hand knowledge of this region and an obvious affection for its peoples. Both these qualities were evident in his earlier book, 'Borneo people,' and they are very much to the fore in this new volume about Angkor. Of the five chapters into which the book is divided, the first and the last deal with the author's own travels in Cambodia, his meetings with Prince (formerly King) Sihanouk, and his observations about contemporary life in Cambodia. They are written with a pleasant informality, but this in no way reduces their success in conveying the atmosphere of this most delightful country. The remainder of the book is concerned with the history of Angkor, the life of the C mbodians (Khmers) during the period of the Angkor Kingdom, and the wonderful series of ruins which still bear witness to its past greatness. Here again the same easy style of writing is adopted and, while the account adds little or nothing to the expert historian's knowledge of the area, it makes an admirable introduction for the general reader. The 112 beautiful photographs, nearly all of which are concerned with the ruins described in the text, form a magnificent collection, which in addition to its popular and aesthetic appeal should prove of real value to the serious scholar.

CHARLES FISHER

FLOOD TIDE IN CHINA. By C. P. FITZGERALD. *London: Cresset Press*, 1958. $8\frac{3}{4} \times 5\frac{3}{4}$ *inches;* ix+286 *pages; endpaper maps.* 25*s*

Professor Fitzgerald's latest book is, in effect, a sequel to his 'Revolution in China,' published in 1952. The present work, which is based largely on first-hand observation made during the course of the author's visit to China in 1956, attempts an assessment of the political, economic and social state of that country after the first six years of Communist rule.

Although Professor Fitzgerald's wide-ranging historical knowledge enables him to place many of the supposedly new and revolutionary features of Communist

China in their true historical perspective, his approach in the present study is only incidentally historical, and he shows a fine sense of geographical values, particularly in his opening chapter on Peking and in his account of the provinces in chapter four. Indeed the study of Peking, which he effectively compares with Paris and contrasts with Nanking, should be compulsory reading for all political geographers, who will likewise find a wealth of thought-provoking observations in the two concluding chapters, "Two Chinas" and "China in Asia."

In his treatment of economic matters Professor Fitzgerald makes no attempt at statistical analysis, and his work contains no lists of rapidly mounting production figures which appear with such monotonous frequency in studies of the new China. But his observations on the applicability or otherwise of the established Communist agrarian policies to the rice-growing lands of southern China are very pertinent, and his account of the great improvement in transport is likewise illuminating.

It is none the less a pity that this book was written before the introduction in 1958 of the new system of communes, and before events in Tibet had thrown new light on the Communist regime's attitude towards minority peoples. In the reviewer's opinion both of these developments serve to underline the difficulty of making a satisfactory assessment of the new China's aims and achievements. But they undoubtedly also serve to reinforce Professor Fitzgerald's argument that the scale and pace of transformation now taking place in China are such that the West can ignore only at its peril. C. A. FISHER

HONG KONG GAZETTEER. By THOMAS R. TREGEAR. *Hong Kong University Press (Macmillan and Co.)*, 1958. $9\frac{3}{4} \times 6\frac{3}{4}$ *inches; 100 pages. No price*

From Mr. K. M. A. Barnett's introduction on Hong Kong place-names the problem is seen to be the provision of factual and accurate evidence to rectify place-names inaccurately rendered on maps in daily use. Mr. T. R. Tregear has ably set out to tackle this situation by original investigation and research for land utilization purposes. The Gazetteer is an index to his Land Utilization Map (1: 80,000) but it is much more than this. Those working in other spheres will welcome his arrangement which allows the romanized form used on a map to be checked with its Chinese equivalent. Students of Chinese may use the stroke index to obtain the local pronunciation. The column giving corrected names reveals some idea of the relatively numerous errors needing correction. On page 16 there is an outline grid for quick reference, which facilitates accurate location of place names in the area.

As far as we know, this is the only gazetteer of its kind; its wide use should aid standardization in the many fields affected, and over a wide area of activities, although the scale restriction will prevent it being an exhaustive study. Mr. Barnett's views concerning the survival of Hong Kong's original languages in local place-names makes interesting reading. Oral tradition has frequently proved reliable in so many cases, it is hoped someone with the time and linguistic gifts for such interesting research will provide further evidence in due course. G. FOX HOLMES

AFRICA

JOURNAL OF AFRICAN ADMINISTRATION. Vol. 10, no. 4, October 1958. *London: H.M.S.O.*, 1938. $9\frac{1}{2} \times 6$ *inches; pp.* 181–264. *2s 6d*

The *Journal of African Administration*, produced by the African Studies Branch of the Colonial Office, has appeared each quarter for some years (*11s 4d* per annum, post free). Most of its articles are written by members of the Overseas Civil Service and are of a specialist nature; but some are of much wider interest and deserve the attention of all concerned with developments in Africa today. Recent numbers of the *Journal* have included papers on resettlement, slum clearance, the problems of land tenure and land registration, and the implications of the Native Land Husbandry Act of Southern Rhodesia. This act, which became law in 1952, was described (vol. 7,

no. 3, p. 109) as "a social, economic and agricultural experiment of the first importance," and by its far-reaching provisions it could transform the human geography of Southern Rhodesia within a generation.

Volume 10, no. 4 (October, 1958), is devoted largely to a full report of the conference on urban problems in East and Central Africa held at Ndola, Northern Rhodesia, in February 1958. Carefully chosen delegates from eight British territories attended, and the special value of the conference lay in the exchange of the widely differing experiences of those who are dealing with these problems in their daily work. Much has been said in recent years of the very rapid growth in the size and populations of African towns and of the increasing tendency for Africans to remain in towns for long periods—even to become permanent residents. These matters were fully studied by the East Africa Royal Commission that reported in 1955, and it is very much in the light of that investigation that the Ndola conference gave further consideration to these problems.

Throughout, the officials concerned bring an air of realism to their deliberations. They recognize that these towns of East and Central Africa, established almost wholly by non-African initiative, have come to stay, and that Africans are now much attracted to them. Conditions favourable to the establishment of stable, integrated urban communities must, therefore, be created. Ideally, residence in different zones should not be controlled by racial criteria—but it is admitted that this ideal cannot immediately be attained in certain territories. Due attention is focused upon the problems that are inevitable where many people congregate in relatively small areas; those of land tenure and housing, for example, and the need for wages policies and for social security schemes. There are also sections dealing with urban administration, finance, the administration of justice, and the maintenance of law and order. It is particularly encouraging to find paragraphs devoted to two hitherto neglected aspects of town life in Africa—the necessity for adequate control in peri-urban areas (well referred to as "the septic fringe" of towns) and the problems arising from the increasing settlement in towns of wives and families along with the menfolk. This last development is welcomed as being highly desirable for social reasons and for the building up of integrated urban communities. In conclusion, the delegates emphasize the need for the establishment of the closest possible ties between urban and rural areas.

The conference quoted with approval the East Africa Royal Commission's view that towns are today "the centres of social and intellectual life, of economic enterprise and of political activity," and it is considered that it should be an aim of policy to create urban communities in which "all persons of whatever race can participate in the social, economic and political life of the town in accordance with their individual abilities." Practical partnership may indeed first show itself in the twentieth century creation, the large African town.

ROBERT W. STEEL

EGYPT IN THE SUDAN, 1820–1881. By RICHARD HILL. *London: Oxford University Press for the Royal Institute of International Affairs*, 1959. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 188 *pages; map.* 25*s*

This new work by Dr. Hill, one of a series of Middle Eastern monographs published by the Royal Institute of International Affairs, is both an important addition to Sudan history and a highly topical contribution to a pressing problem in "Middle Eastern" affairs. In terms of history, it follows Dr. A. J. Arkell's 'History of the Sudan to A.D. 1821' and is in turn followed by Dr. P. M. Holt's 'The Mahdist State in the Sudan, 1881–1898.' With this latest addition by Dr. Hill, an up-to-date and almost complete history of Sudan is available to those, historians or geographers, concerned with the country's complicated past, and with the background to present events.

The principal object of Dr. Hill's book is to explain the nature and significance of the Egyptian occupation of Sudan which was by no means the long tale of oppression, graft and slavery that it is generally made out to be, though it was not quite as pure

and undefiled as Egyptian writers like to protest. The Sudan today indeed owes much to the Egyptian legacy; in the pattern of its local and provincial government, in the basic organization and nomenclature of its army, in the building of its railways, and in the machinery of Nile irrigation and control. In religious and cultural matters, the legacy of Egypt has been valuable and lasting. Theological discipline infused from Egypt was a valuable corrective in the heterogeneous, superstitious medieval world of Sudanese Islam. The Egyptian cultural contribution moreover has enabled Sudan to participate in the cultural renaissance of the Arab world. When so many are suspicious of Egyptian ambitions which have seemed at times to threaten the freedom of Sudan as of other neighbouring countries, it is as well to be reminded by Dr. Hill of these past benefactions in this scholarly and eminently fair assessment.

L. P. KIRWAN

21 FACTS ABOUT THE SUDANESE. Prepared by KAROL JOSEF KROLKI. *Printed in Salzburg for Population Census Office, Ministry for Social Affairs, Republic of Sudan.* 11 × 8½ *inches; 60 pages; maps, diagrams, plates, tables. No price*

The new maps of Sudan, described in a note on page 132 of volume **125** of the *Geographical Journal*, March 1959, seem likely to prove only the forerunners of a number of maps illustrating aspects of the results of the First Population Census of Sudan 1955–6. Already an official summary of some of the results—K. J. Krolki's '21 facts about the Sudanese' (in English)—has been published with seven further maps, and in Appendix 2 (p. 53) the production of 31 further maps at various scales is forecast. Some of these will have as many as 15 sheets, and there will also be 68 town plans of all the towns enumerated in the census.

'21 facts about the Sudanese' contains a great deal of useful demographic information about Sudan. It has appeared with much greater speed than is normal; it is not however easily written and the production seems to have suffered from lack of supervision. These details should not be allowed to detract from its obvious value as a handy work of reference on the human geography of Sudan.

It contains five maps showing "population centres," the percentage of West Africans and of Arabic speakers, and crude birth and death rates, all calculated on the same basis (the 94 Census Areas) as the maps already noticed in the *Journal*. It also has two larger maps at a scale of 1 : 4,000,000 showing the density and distribution of population in greater detail compiled by K. M. Barbour, lately of the University of Khartoum. These maps have been constructed on a different and more appropriate basis, and reveal a detailed complexity of pattern which is quite distinct from that of any of the other maps published so far.

Among the maps which are intended to accompany the "Final Report" are a "Dot Map" of the distribution of population at a scale of 1 : 1,000,000, which should accord with the plans of the Special Commission on World Population Mapping of the International Geographical Union, and also a "Location of 'Omodias'" map in 15 sheets at a scale of 1 : 1,000,000. The "Omodia" may be taken as the basic local government unit in Sudan, though the term is not easy to apply over the whole country in the same sense.

W. P. G. THOMSON

A SURVEY OF NORTH WEST AFRICA (THE MAGRIB). Edited by NEVILL BARBOUR. *London: Oxford University Press*, 1959. 9 × 5½ *inches; 406 pages; maps.* 35*s*

Issued under the auspices of the Royal Institute of International Affairs, this is a factual survey of the vast area lying between Morocco and the western frontiers of Egypt and Sudan. The editor has had experience of the Middle East and North Africa since 1926, and was formerly Assistant Head of the Eastern Services of the B.B.C. He has been assisted by an international team of experts, but unfortunately he does not list them fully. The bias of the survey is historical and political, extending widely in its scope of history, though with an eye on the present situation. The

survey does not hesitate to face a number of vital questions frankly. Who should profit in the first place from the wealth of the Sahara, the French or the North Africans? Who is to feed, educate and employ the Muslim masses? How are the surging forces of nationalism to be canalized? The editor does not hesitate to show where he stands on such issues.

After an introductory section on the history of the Magrib, the book is divided into three parts, dealing respectively with Morocco and Spanish West Africa, Algeria, Sahara and Mauritania, and Tunisia and Libya. In each country, reference is made to the geography and population, history, politics, social and economic conditions. In places there is an irritating repetition of statements made elsewhere, suggesting the book is intended to be read as a reference work.

It is well written, in concise, clear language, and the maps of the political boundaries are useful. But the author is not on sure ground in his geographical sections which are much shorter than the historical outlines. The value of the work lies in the up-to-date information and background data. It is topical only in the sense that it is designed to prepare the reader for whatever developments may occur in the next few years. This work is an informative and authoritative survey, useful to both the general reader and the student of international affairs. J. M. HOUSTON

A GEOGRAPHY OF GHANA. By E. A. BOATENG. *London: Cambridge University Press*, 1959. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi+205 *pages; sketch-maps, plates and tables.* 21*s*

This is the second advanced text on the geography of Ghana to be published within the last twelve months, and it provides further evidence of the way in which geographical studies are being encouraged and advanced from the University College of Ghana. Moreover, this is the work of Ghana's first university teacher of geography. Mr. Boateng may be well pleased with his work which has been attractively produced and illustrated. It is divided into three main sections—"The land," "Human response" and "Regional pattern"—of which the first two are systematic in their approach. In the third section there is a genuine attempt to establish regional identities which are based on differences in relief and structure. In the integration of other elements one feels that there is something gained in having a Ghanaian writing of his own country. The book is not without blemish. It is unfortunate that there is merely reference to and no attempt to explain the anomalous dry zone along much of the coast of Ghana and its immediate hinterland. The chapter on trade is very meagre and disappointing, particularly on internal trade which has been studied by a geographer in Ghana. Since he hopes that his book will be read by university students and the interested public, in this and in other respects (*e.g.* agricultural regions, ports and communications and the Accra Plains) the author should have given references to detailed published work so that this can be consulted. A brief bibliography of the geography of Ghana would indeed have been of value. Maps on the whole are useful and well drawn (Fig. 20, "Minerals," omits several of the important mining centres mentioned in the text). The photographs are, without exception, of high quality and the majority of them are well chosen. They might have been better integrated with the text rather than bound together at the end of the text. The book seems to end rather abruptly with the last of the regions dealt with. In several of the chapters there is reference to future prospects but some final overall view of Ghana and her problems in their geographical context would have been valuable. R. MANSELL PROTHERO

THE ASHANTI: A PROUD PEOPLE. By ROBERT A. LYSTAD. *New Brunswick, New Jersey: Rutgers University Press*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 212 *pages; endpaper maps and diagrams.* 40*s*

Alongside the many learned but often rather ponderous anthropological treatises of today, it is refreshing to a geographer to find a social anthropologist who can write so readable a book and who is prepared to generalize at times on the basis of the particular. This book, the author writes, "concerns a few people, but a few can reveal

a great deal about many others." Throughout the book it is obvious that to him "the best road to enjoyment in Africa" has been "living with Africans and trying to learn a little of what it is like to be an African."

The Ashanti are a comparatively well-known African tribe, thanks to the pioneer work of R. S. Rattray and more recently to the studies of M. Fortes, Eva L. Meyerowitz and K. A. Busia. But a new appraisal of them is of value in view of the great economic developments and political advances of recent years. Dr. and Mrs. Lystad, two of the many Americans brought to tropical Africa under the various post-war research programmes, lived for eight months in Goaso, the administraitve headquarters of the Ahafo District, one of the newer cocoa-farming areas of Ashanti. During that time they entered fully into the life of the community and so gained a real insight into it, despite all its complexities.

After describing the essential geographical features of Ashanti and Ahafo, Dr. Lystad examines the Ashanti way of life in a simple, straightforward and attractive manner. All who know and respect the Ashanti will be grateful to the author for his picture of these essentially country people, "creating their livelihood and their proud culture out of the African soil," and for his assurance that, despite all the changes of the modern age, "its people will remain proud people."

Such a valuable study of the people that constitute the core of the opposition to Dr. Nkrumah's government in Ghana today deserves wide circulation throughout the English-speaking world if there is to be a public opinion that is well informed on the intricacy and depth of African nationalism and tribal society at the present time.

ROBERT W. STEEL

ETHIOPIA TODAY. By ERNEST W. LUTHER. *Stanford: Stanford University Press; London: Oxford University Press*, 1958. $8 \times 5\frac{1}{2}$ *inches;* vii + 158 *pages.* 25*s*

This is an unpretentious, sensible and useful work by an American who spent the years 1950–6 as an economist with the Ethiopian State Bank. It is not free from errors. John IV was killed in battle not against the Mahdi but against the Khalifa's general (p. 17); Tellez was a seventeenth not eighteenth century writer (p. 37). Such mistakes, however, matter little in a book of this kind and only a few are serious. Some of the references to "tribal chiefs" may obscure the fact that over much of the country the social structure is feudal rather than tribal. The Blue Nile does not originate in Lake Tana (p. 7); the lake originates in the river. A misprint may be to blame for the implication that the Somali were converted to Islam a few centuries before Muhammad (p. 10). The phrase "eight centuries of effort on the part of the Ethiopian Church to achieve independence" (p. 33) is not justified; until modern times there is very little evidence for any such thing. Even when there is, as in the early sixteenth century, it is apparent that the Ethiopian aim was not so much independence as dependence on a see with which communication would be easier than it had become with the Coptic Patriarchate. The book is good enough for these understandable errors to be worth correcting but it would be very unfair to stress them. The description of the economy, which is the author's principal concern, is lucid, comprehensive and judicious. Much of the information has hitherto been accessible only in official reports and it is valuable to have it presented systematically and assessed by someone of Mr. Luther's experience. He shows no tendency to flatter the Ethiopian government or people in the way that such writers often do, and a scathing footnote is devoted to a well-known British panegyrist of Ethiopia. He remarks upon the neglect of the roads and cotton plantations left by the Italians and of the water-wells sunk in Ogaden by the Sinclair Oil Company. He is insistent that if Ethiopia is to be modernized the first requisite is not capital "but the services of a self-reliant, enterprising, and imaginative leadership that is able to rise above the debilitating influences of the society from which it has sprung" (p. 65). Similarly he considers the establishment of democratic institutions to be impeded not so much by governmental repression as by popular incomprehension and apathy and by the persistence of traditional

assumptions and attitudes. He thinks it "all too likely that the future will see a gradual withering of the spirit of independent government in Eritrea and the ultimate domination, if not absorption, of that government by Ethiopian centralism" (p. 147). Mr. Luther naturally assumes that economic and political development is desirable; he is in no doubt that the overwhelming majority of Ethiopians are not interested.

C. F. BECKINGHAM

POPULATION PRESSURES IN AFRICA SOUTH OF THE SAHARA. By Richard W. Stephens. *Washington, D.C.: Population Research Project, George Washington University*, 1958. 9×6 *inches*, 48 *pages*

There is no doubt of the need for a complete and balanced understanding of the problems of population and land resources in Africa and in other parts of the world. This has been attempted in many different ways during the past decade and this monograph is part of a Population Research Project which is directed towards the same end. This bringing together of material relevant to the study of population pressures in Africa south of the Sahara is useful and the author has read widely, if not always with complete understanding, in this field. This is essentially a compilation of information under two main headings—demographic trends and characteristics and economic development and potential. There is not a great deal of integration of the material and little in the way of original conclusions. To achieve these successfully would be an enormous task, requiring an author with great breadth of knowledge and a profound understanding of the problems of African environments and peoples. One cannot feel that these exist with the author of this work. There are in fact some errors which should not have occurred and which leave the reader a little dubious. The discussion of the growth of population in Nigeria (p. 6) is confused and the first census there was not completed in 1948 but in 1952/53, and it is doubtful if anyone would claim that it was "really accurate." There is no "large-scale European plantation system" producing cash crops for export from Uganda. It is difficult to understand how land and population in British East Africa can be discussed without reference to the recent Royal Commission, though its report is listed in the bibliography. A satisfactory analysis of population/land relationships in Africa south of the Sahara has still to be undertaken though this work is a contribution in that direction.

R. MANSELL PROTHERO

THE BIRTH OF A DILEMMA: the conquest and settlement of Rhodesia. By PHILIP MASON. *London: Oxford University Press*, 1959. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches*. 366 *pages; plates and maps*. 30*s*

This book is the first instalment of a larger plan of history; it carries the story only as far as the 1914 war. Mr. Mason starts in Part I with an assessment of "The Bantu achievement" before European contact, and moves on in Part II to an account of Lobengula, the Matabele war and rebellion, and the final settlement. His third and last part deals with the relations of conquerors and conquered, with special sections on the land and the concept of Native Reserves; the sexual side of the colour bar; and the working of trial by jury in Rhodesia.

Perhaps the outstanding impression made by this book is the author's continual effort to be fair to both sides. Again and again, in face of actions which 1959 liberal judgment would unhesitatingly condemn, he has gone back to the 1890's, put himself in the shoes of the pioneer, and exposed the hypocrisy of moral judgements from a contemporary England deeply stained with moral faults. Admirable as this endeavour is, it is, in a strange way, both distracting and unsatisfactory for the reader. Distracting, because it tempts him to play a stupid detective game, watching for the tiny clues which show the author's real opinion; unsatisfactory, because history of this kind is, and must be, an act of selection and judgement by the historian; it is therefore tantalizing when, at each crucial point, the judgement is blurred. Perhaps it would need an

age of greater self-assurance and more distant in time to make the judgements; but what we cannot have we still may miss.

There is, too, a touch of uncertainty about scale and form. In Part I, Mr. Mason is in some degree popularizing the work of anthropologists and historians on Bantu origins; in Part II, where he is often at his best, he is the careful narrative historian, noting dates and documents and references, and yet making his story live. In Part III, narrative is largely abandoned and we are in the field of social and psychological argument, illustrated by certain selected facts. The introduction and epilogue are straight arguments on the nature of the Rhodesian dilemma and of the longer impact of the West on Africa. It is not easy for the reader to adapt himself smoothly to these changes; partly because he is at one moment accepting the author's invitation to live patiently in the 1890's and at another involved in argument which could only be formulated as it is by knowledge of 1959. Mr. Mason has attempted a difficult task—neither pure history nor pure comment, neither a scholar's book nor a popular summary; neither a polemic nor a narrative. It is not surprising that all the compromises do not lie altogether happily together.

Despite these criticisms, 'The birth of a dilemma' is an achievement enormously creditable to the author. Sensitive, fair-minded, often scholarly, occasionally witty, far-ranging in many fields of thought, always humble in its assessment of the problems and motives faced by other men in a distant and more dangerous age, it is compact with the very virtues which political controversy sadly lacks. As an intelligent man's introduction to the Rhodesian problem it could hardly be bettered. Let us hope that in future volumes Mr. Mason, whose integrity and goodwill are assured, will have the courage to be both more concise and more decisive in argument and in judgement.

GUY HUNTER

THE JOURNAL OF JAN VAN RIEBEECK. Edited by H. B. THOM for the Van Riebeeck Society. Vol. III. *Cape Town and Amsterdam: A. A. Balkema*, 1958. 531 *pages;* 10×7 *inches; illustrations and maps.* 100s *the set of three volumes*

Volumes I and II were reviewed in *The Geographical Journal*, **121** (1955), p. 527. The appearance of Vol. III covering the years 1659–62 marks the completion of the task begun in 1948 of publishing the journal maintained by Jan van Riebeeck, Commander of the Dutch colony at the Cape of Good Hope from its inception in 1652 until his transfer to Batavia. Incomplete and imperfect versions of the journal have been printed before, but every care has been taken to ensure that the present publication is as full and accurate as possible. The chief source was the better-preserved contemporary copy at The Hague, whilst the original at Cape Town was also used. The Gothic-Netherlands script was deciphered and transcribed by a team headed by Dr. D. B. Bosman, who edited the three-volume Dutch edition that is in the language and spelling of the original. Its translation for the English edition was by other collaborators under Dr. H. B. Thom, who also wrote the historical notes in both editions, assisted by a panel of experts over a wide field. The Union Government contributed towards the publication costs.

The journal is much more than a grave recital of administrative affairs. It presents an often vivid picture of life in the settlement and outposts: alarms, accidents, conspiracies, shipwrecks, encounters with wild beasts, and the endless negotiations and occasional skirmishes with the Hottentots. In Vol. III alone, over sixty pages contain instructions to and the detailed diaries of expeditions sent to barter stock, to investigate agricultural, pastoral and mineral possibilities in the interior, and to seek the mythical cities of Vigiti Magna, Davagul and Monomotapa.

The interior now yields gold and precious stones, corn and cattle in an abundance then undreamt of; but the solution of the problem of the relationships between white men and black seems no easier today than when Jan van Riebeeck grappled with it three centuries ago in his wooden fort upon the shores of Table Bay.

V. S. FORBES

NORTH AND CENTRAL AMERICA

THE BOURDON PLANS FOR THE FIRST FRENCH SETTLEMENTS ON THE ST. LAWRENCE: 1635–42. *Montreal: Cambridge Press*, 1959. *Plans in folder* 17½×10½ *inches.* £4 10

Eight original plans by Jehan Bourdon of French settlements of the Saint Lawrence were recently acquired by the McGill University Library. Bourdon (1602–68) was Surveyor General to the new colony and drew up these plans in that capacity. It was desired to make these important plans—"the earliest Canadian maps to survive"—readily available to scholars, so they have been published without a historical introduction, in advance of the long study they require. A set is available in the Society's Map Room. The facts, on which this note is based, are given briefly on the cover. The set includes the fort of Quebec, 1635, the first settlement at Montreal, and the Richelieu fort, of which no plan has hitherto been known.

The edition of 250 numbered copies has been prepared at a price of £4 10 post free, and may be obtained from the McGill University Library, 3459 McTavish Street, Montreal, Canada. G. R. CRONE

MEXICO, THREE-STOREYED LAND. By A. T'SERSTEVENS. Translated by Alan Houghton Brodrick. *London: Hutchinson*, 1959. 8½×5½ *inches;* 368 *pages; map and plates.* 35*s*

This is not an altogether successful book. There are purple patches, and the translator has not quite succeeded in concealing his presence. Nevertheless, it can fairly claim to be a lively and in parts penetrating account of ten months' determined travelling. The title is certainly apt: three physical zones (*tierras calientes*, *templadas* and *frías*), three civilizations (pre-Columbian, colonial Spanish, modern American), and three human groups (Creole, *mestizo*, Indian).

M. t'Serstevens is at his best when writing of local customs and the fine arts. A *fiesta* at San Miguel Allende is beautifully portrayed. The originality and good taste of Indian craftsmen are set against the pretentiousness of Spanish colonial baroque. Fortunately, the two occasionally combine to produce, at best, the sheer miracle of the Capilla del Rosario, Puebla. The description of physical features is least satisfactory; one or two of the excellent photographs best convey the astonishing range of country. The varied rural scene is given some prominence: deforestation around pottery villages, the ploughing of precipitous slopes, burning maize straw to enrich the soil, hamlets which have grown up around former missions and old *haciendas* . . . (the description of a working *hacienda* at Zacatepec is one of the best things in the book). The towns, usually with a central *plaza* and a grid plan, are almost wholly post-Columbian (in perhaps all but two cases the sites were either freshly chosen or earlier monuments were razed). The most persuasive evidence of the millennia-long tenancy of the Indian lies, fittingly enough, at a humbler level—in his strikingly developed range of crops and herbs, in his profound knowledge of plant life generally.

The sketch maps are unnecessarily simplified. The "topographic" maps of petrol stations and the *Turismo* are not the only ones available as is suggested, and Cortés's route from the coast to Tenochtitlan (part of the "most astounding exploit in all history"), which the author claims to have plotted with much trouble, might profitably have been included. R. A. DONKIN

AUSTRALASIA

JOHN MCDOUALL STUART. By MONA STUART WEBSTER. With maps by Mary Quick. *Melbourne: University Press*, 1959; *London agents: Cambridge University Press.* 8½×5½ *inches;* 320 *pages; plates, maps, appendices.* 42*s*

In these days of airborne travel and motor transport the long journeys of John McDouall Stuart through virgin Australian country from Spencer's Gulf to the Timor Sea are nearly beyond belief. It is well that we have writers such as Mona Webster to

devote so much time to describing the difficulties so painfully and conscientiously surmounted. To one who has camped on the "gibber" plains and seen the vast distances of the inland, Stuart's sufferings and achievements arouse the deepest pity and appreciation; Australia certainly owes him much, and the total sum of knowledge gained by the six expeditions were probably of more value than if it had been possible to achieve his object in one journey. Stuart was awarded the Society's Gold Medal in 1861, and died at the age of fifty-one, worn out in the service of his country. The political discussions and disagreements which form part of Stuart's story make sad reading. It is difficult for us today to realize the strain, because of inexperience and distance from the responsible government at home, which was put on remote colonial governments in those days. Mona Webster writes throughout with feeling and understanding, and her book, a well documented and valuable addition to Australian biographies, is rich in maps and illustrations. The appendices, if rather numerous, will be a source of interest to the keen student of Australian history.

PAQUITA MAWSON

GREAT DAYS IN NEW ZEALAND MOUNTAINEERING. By JOHN PASCOE. With foreword by Sir Edmund Hillary. *London: Bailey Bros. & Swinfen, and Wellington, N.Z.: A. H. & A. W. Reed*, 1958. 8½×5½ *inches;* 199 *pages; sketch-maps and plates.* 21*s*

As Sir Edmund says in his foreword, "John Pascoe's contribution to mountaineering in New Zealand has been a long and valuable one. . . . He is also a profound scholar of the early history of New Zealand mountain exploration," an observation instanced by Pascoe's 'Mr. Explorer Douglas,' reviewed in this *Journal*, **123** (1957), pp. 547–8. Consequently, there can scarcely be anyone better qualified for the task presented by this particular volume of a series which deals with "great days" in various aspects of New Zealand sport. Within nineteen chapters the author has packed in, perhaps, the chief epics in the history of mountaineering in the Southern Alps proper, as well as such outlying mountains and ranges as the Kaikouras, the Spensers and the volcanoes of the North Island. Appropriately commencing (chap. 1) with "Massive and highest: Mount Cook," and terminating (chap. 19) with "A giant above the sea: Mount Tutoko," he has extracted the most important and dramatic events in the lengthy record of ascents of all kinds throughout New Zealand's mountains, whether in summer or in winter. It is the exploits of others, rather than his own, which are narrated so vividly and in such a crisp easy style. But in chapter 6, "A westland memory: Mount Evans," one of the best in the book, we are given an account of one of his own early achievements in the first ascent and traverse of this redoubtable peak. The simplified sketch-maps of the localities described are a valuable accompanying feature, whether for the actual mountaineer or for the layman for whom the author claims the book to have been written.

N. E. ODELL

ESPIRITU SANTO (NOUVELLES HÉBRIDES). By JEAN GUIART. *Paris: Librairie Plon*, 1958. 8½×5¼ *inches;* 236 *pages; plates, diagrams and maps.* 600 *frs*

Professor Jean Guiart, Director of the Laboratoire d'Ethnologie at the Institut Français d'Océanie at Noumea, is well known for his writings on Melanesia. The present volume is addressed to all w would try to understand the problems of administering and developing the New Hebrides Condominium. Espiritu Santo, the largest island in the Condominium, has many problems of which the most pressing arise from differences in the way of life between the pagan, often hostile, tribes of the interior and the more advanced peoples, *indigène* and immigrant alike, living along the coast.

The core of the present volume is a careful analysis of observations made during five field trips undertaken by M. Guiart in 1947 into the interior for the Government. His account is illustrated by carefully chosen photographs and a map showing the position of the many villages visited. Readers of the *Geographical Journal* will find his account of particular interest because he retraced some of the routes followed by John R. Baker and Tom Harrisson some fifteen years earlier.

Guiart supplements the account of his field observations with a discussion of the structure and customs of the several tribes; this is enriched by his knowledge of other Melanesian peoples. He also considers briefly reasons for the hostility of the tribesmen towards Europeans, missionaries and government officials alike. Among the matters discussed are the affairs of Rongofuro, Avu-Avu, and Atori respectively; he also discusses the so-called "Naked Cult."

Several times, M. Guiart apologizes for not writing a classical ethnographical study, but he has no need to be ashamed of the present volume. Its purpose was different. The study was called into being by the Government of the Condominium in 1945; they desired some knowledge of the then almost unknown inhabitants of the interior of Espiritu Santo. M. Guiart's conclusions are interesting. He sees in the interior of Espiritu Santo, as elsewhere in the Condominium, the beginnings of nationalism and a desire for autonomy. Anti-foreign feelings which break out from time to time have their root in the desire for full equality with Europeans and other immigrant peoples.

E. M. J. CAMPBELL

PHYSICAL AND HUMAN GEOGRAPHY

PHYSICAL GEOGRAPHY. By PHILIP LAKE. Fourth Edition, under the editorship of J. A. STEERS. *Cambridge: University Press*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xxviii+483 *pages; maps, diagrams, plates.* 25*s*

The fourth edition of Lake's text-book retains its old excellence, while providing new additions to its familiar features. For the information on soil science required in recent years by examining bodies, it has hitherto been necessary to turn to some other book; now "Lake" includes a chapter on soils by A. T. Grove. The importance attributed to the study of biogeography is recognized by the addition of another new chapter, by A. J. Lee, whose contribution is remarkably lucid, although for its full appreciation a considerable knowledge of zoology is required. Familiarity with the concepts of plant ecology is also assumed in the chapter on soils. Now that such vast fields have been added to the subject of "physical geography", one is left wondering where the process will end and how much more the student will be expected to digest. Throughout the main part of the book the changes from the third edition are mostly in the form of extra details and minor qualifications and caveats, especially in the sections devoted to oceans and to land forms. Inevitably but regrettably the type has been reduced in size, but the concentration of the plates at the beginning makes for greater ease of reference, and the bibliography is enlarged. The only other major change is one of revolutionary importance: a new chapter on the physiographical effect of storms stresses the conclusion of the late Dr. W. J. Arkell that the result of occasional catastrophic storms must be accepted as part of the regular cycle of erosion.

M. A. ARBER

ELEMENTS OF GEOLOGY. By James H. Zumberge. *New York: John Wiley*, 1958. $9\frac{1}{2} \times 6$ *inches;* 382 *pages; maps and illustrations.* 44*s*.

At first glance this would seem to be one more contribution to the spate of expensive glossy "Elements of . . .," "Introductions to . . .," "Outlines of . . ." or "Principles of . . ." this or that subject flowing eastwards across the Atlantic. Superficially this is so. Forty-four shillings is not cheap in a country where similar books can be purchased for less than five in paper-backed editions. Glossy it is from its dust jacket through its glacier-pictured, hard-board covers to the extremely well illustrated pages inside. Like many others of its kind its writing has been prompted by the need to provide "the book" for short courses in geology in universities in the U.S.A. This is a lucrative market indeed when the student must perforce take courses in a wide range of subjects. The particular merit of this book is the author's attractive style of writing. One can well believe that it is capable of stimulating in a beginner a desire to

pursue the subject further. It is well planned and wisely illustrated, but marred to some degree by the absence of a list of figures, which are numbered chapter by chapter. Much of the value of the book is lost by transplanting it to Europe without translating the illustrations into terms and locations which have meaning to its intended readers. This fault is common to most, if not all, American texts in the natural sciences, which are sold on the European market. ERIC H. BROWN

KLIMAMORPHOLOGIE DER MASSENGESTEINE. By HERBERT WILHELMY. *Braunschweig: Georg Westermann Verlag*, 1958. $9^{1}/_{2} \times 6^{1}/_{2}$ *inches; 238 pages; diagrams, illustrations.* DM.35.80

PROBLEME DER OBERFLÄCHENFORMUNG IN GROSSBRITANNIEN UNTER KLIMAMORPHOLOGISCHER FRAGESTELLUNG. By L. HEMPEL. *Petermanns geogr. Mitt.*, **102**, 2 (1958), pp. 81–9

In the development of land forms three groups of contributory factors may be distinguished: the endogenetic or tectonic "t"; the exogenetic or denudational "d"; the petrological "p". In quasi-mathematical terms, land form "l" = *f*t.d.p. If this equation expressed a relationship in an experimental subject it would perhaps be possible to keep any two of the right-hand factors constant in order to study the change in the left-hand variable produced by variation in the remaining right-hand factor. In contrast, much of the intellectual stimulus of geography (both on its human and physical sides) derives from the fact that the experimental method is rarely applicable and the problems must be solved in some other way.

In German geomorphology little attention was given formerly to variations in the denudative processes "d". Penck was most concerned with the relationship between land forms and the endogenetic forces. His work may be subjected to the criticism that insufficient consideration was given to variations in the denudative processes due to differing climates. In other words, the differences in land form that he attributed to changes in the tectonic forces might possibly be due to variation in denudative process or petrology. He examined the relationship between "l" and "t" without keeping the other two variables "d" and "p" constant.

In recent years, however, German geomorphologists have turned afresh to the study of weathering and transportation processes in different climates, and so has arisen *Klimamorphologie*. This may be said to show a marked parallelism with Davisian thought, but is distinguished from it by the very careful attention given to the processes themselves, rather than to the cyclical development of forms under given climatic conditions. It most certainly indicates a line of advance at least as important as the American application of statistical methods, and there can be no doubt that Dr. Wilhelmy has made a most valuable contribution to our subject.

He has attempted to hold the "p" factor constant by limiting his examination to the massive igneous rocks, and to study the variation in land forms in such rocks due to different climatic regimes. In hot wet climates, for example, igneous rocks are subjected to an intensive chemical weathering which produces rounded remnant blocks embedded in detritus. Tropical areas with a seasonal rainfall constitute the zone of inselberg formation. The sharp break of slope at the back of the pediment is only present, however, if the rainfall is within certain limits. If the rainfall is too high the slopes are smoothed with the detritus from chemical weathering; if the rainfall is too low the scree cannot be removed. One of the points of difficulty, and of great interest, derives from climatic change. In temperate lands especially, many traces of former weathering processes are to be discerned. Thus it is considered that tors are the product of deep chemical weathering in Tertiary time. Some rocks, where joints were widely spaced, survived the weathering buried in detritus, which was subsequently removed by Pleistocene solifluction. The examples of this quoted are situated in the Hercynian lands of Germany, but the conclusions are similar to those of Linton, one of the few Englishmen to whom reference it made.

Little attention is given to transportation; the emphasis is on minor rather than major relief forms, but the book is a scholarly and systematic study of weathering processes for which it is difficult to cite a parallel. Clearly written and well illustrated, it is an essential purchase for all university libraries.

Dr. Hempel's paper represents the application of *Klimamorphologie*, as discussed above, to British landscapes. Although it may be said, not unkindly, that the paper is occasionally a little naive, it is undoubtedly stimulating for it interprets our landscape in terms of a group of preconceptions different from those held by the majority of geomorphologists in this country. Dr. Hempel is, of course, aware of this difference but tends to exaggerate it. Thus he, like Dr. Wilhelmy, acknowledges Linton's work as one of the few English examples of recognition of past-contrasting processes in the present landscape, but A. J. Bull's "Cold conditions and land forms in the South Downs" (*Proc. Geol. Ass., Lond.*, **51** (1940), pp. 63–71) is representative of a more general recognition of the former dominance of cold climates and the processes associated therewith. Indeed, the former extent of periglacial conditions has received considerable attention both here and in America. Furthermore, the view that some of the high surfaces of Wales and Dartmoor were formed under arid conditions has been widely canvassed.

Unlike Dr. Wilhelmy, Dr. Hempel is not concerned with one type of rock; he attempts to keep "p" constant, by comparing areas of outcrop which he considers to be similar—for example, the Chalk of the North Downs and that of Cambridgeshire, the Jurassic escarpments near Bath and those near Rugby, the Greensand of Kent and that of Sussex. Thus the gentle slope, from the Greensand outcrop, of the Cambridgeshire Chalk contrasts markedly with the bold escarpment of the North Downs, and it is concluded that the former feature must have been developed when the different resistances of the Chalk and Greensand had little effect. From parallels with the *Muschelkalk* in north Germany, it is concluded that the Cambridgeshire feature is of Tertiary age, and that a similar surface of the North Downs has been largely destroyed by the Thames system during the Quaternary Era. Such an interpretation of the upper levels of the North Downs is generally in accord with the expressed views of Linton and Wooldridge concerning a Miocene surface in the Weald, subsequently largely eroded. In other words, the application of *Klimamorphologie* here leads to no change of interpretation. However, the suggestion that the Cambridgeshire feature is of like age is of interest, since the destruction of the Miocene surface in the Weald is due to its height above base-level. Nearer the North Sea, similar age features may be better preserved, but unfortunately Dr. Hempel does not give sufficient consideration to the effects on the Cambridgeshire Chalk of the Chalky Boulder Clay Ice Sheet.

With similar reasoning Holmesdale is contrasted with the Vale of Sussex. The steep edge to the Greensand in the northern vale is attributed to the destruction by the River Medway of an erosion surface more completely preserved in the southern vale, where consequently no important structural feature has developed. Here again the interpretation is an interesting one, but is marred by the fact that Dr. Hempel has not kept "p" as constant as he hoped. There are big differences between the Greensand on the north and south side of the Weald. The same error appears in the Jurassic examples, for there are likewise considerable differences in the development of the massive limestones between Gloucestershire and Northamptonshire.

Nevertheless, despite the omissions, and because of its freedom from our preconceptions, the paper is one of which geomorphologists should most certainly be aware. *Klimamorphologie* is applied to the *Rumpffläche* of Salisbury Plain, the Luton-Bedford district, parts of Wales and the Scottish Highlands, the Cleveland Hills, and to the problem of peat erosion. In all the applications something useful emerges, even if there is an occasional want of certain geological facts (surely inevitable when dealing with a foreign country).

E. M. YATES

ZEITSCHRIFT FÜR GLETSCHERKUNDE UND GLAZIALGEOLOGIE: Band 4, Heft 1–2. *Innsbruck: Universitätsverlag Wagner*, 1958. 8½×5½ *inches; 168 pages; plates, maps*

The longer articles (*Abhandlungen*) in this issue begin with a paper by W. Ambach on a method for determining the meltwater content of snow by measuring its dielectric constant using a bridge method which does not depend on having alternating current of known frequency available—it is thus suitable for field use, and should prove valuable. Next, G. J. Heinsheimer discusses the possibility of there being a liquid water film between ice grains in glaciers; unfortunately his paper is based on what seems to be a misunderstanding of work by C. L. and C. R. Hosler—they demonstrated the supercooling of water in capillary tubes in the absence of ice nuclei, not a depression of the equilibrium freezing point—so that the conclusions drawn are open to question. Then W. Pillewizer summarizes the different conditions which can produce the sharp velocity discontinuities at the margins of glaciers known as *Blockbewegung*, and discusses the cause of this kind of motion, and O. Förtsch and H. Vidal present the results of detailed seismic investigations on a small glacier mainly composed of firn for which they have deduced its bedrock topography. The next paper, by W. Hofmann, presents the results of two German photogrammetric determinations (in 1952 and 1956) of the surface contours of the Nisqually Glacier in the Cascade Range (north-west U.S.A.). Between the two surveys the glacier was advancing, and a comparison of the two maps, obtained by using an overlay on the first map (at scale 1 : 10,000), gives a graphic impression of the changes during the period, which are discussed in the paper together with the results obtained, also photogrammetrically, for the velocity of the glacier at an interesting profile at the time of each survey. G. J. Heinsheimer then has a second paper, this one recording the latest events in the frontal history of the Ventisquero Moreno in Argentina—a glacier which advances to block a lake from time to time, and which, during the period recorded here, maintained the ice dam for a longer period than any previously observed. W. Schwerdtfeger discusses the climatic conditions in the Patagonian ice fields and, in the final paper of this section, H. Gams describes a kind of marsh (*Staumäandermoore*) caused by meandering in glacio-fluvial deposits. The shorter papers (*Mitteilungen*) are, as usual, more related to the *Glazialgeologie* of the title—one by H. Svensson on the shape of glacial valleys, one by C. Lebling on a Mindel-Riss Interglacial deposit in Austria, two papers, one by W. Sitte and one by H. Bögel, on morainic terminal deposits, and a short note on a glacier in Iran. The *Berichte* section contains details of measurements made on Austrian glaciers in 1956 and 1957 as well as conference reports, and the *Nachrichten* contain one longer obituary and an interesting paper on an historical visit to glacier tunnels dug during the First World War. Book reviews complete this issue.

J. W. GLEN

A GEOGRAPHY OF CLIMATE: THE SYNOPTIC WORLD PATTERN. By J. GENTILLI. 2nd revised edition. *Perth: University of Western Australia Press*, 1958. 8½×5½ *inches; 172 pages; maps and diagrams.* 12*s* 6*d*

This little book presents a "global view of the climate elements both in time and space." A second edition indicates that the plan of the book, in showing the distribution of winds, temperature, rainfall, etc., in relation, essentially, to parallels and meridians, has been found useful. The author is well abreast of modern meteorological theory and, considering the condensed character of the work, his explanations are mostly very clear. But the fact that in his own words "regional and physical climatology have been rigidly excluded compatibly with the clarity of the text" is not always at all compatible with such clarity. Thus the perplexing statement on page 45 in relation to free-air temperature distribution in the trade wind area that the "atmospheric circulation is not helped by the contrast in temperature between equator and pole" needs much clarification. The area around Verkhoyansk in north-east Siberia is taken on page 21 to represent 100 per cent. continentality; but there is much to

be said for regarding this extreme region as decidedly "super-continental" after Spitaler, with an index of continentality well over 100 (see *Geogr. J.*, **64**, 1 (1924), pp. 43–56).

A diagram on page 8, showing how the intensity of solar radiation received on a horizontal surface varies with the sine of the angle of incidence and with thickness of atmosphere traversed, will repay study. As the explanatory text points out, when the angle of incidence is 30 degrees the intensity is half that at 90 degrees. In other words, at the equinoxes, when the sun at noon is vertical over the equator, the intrinsic intensity is reduced to a half as far north or south as latitude 60 degrees; but, as in that latitude the thickness of atmosphere which the radiation has to traverse is doubled, its effective intensity through a clear atmosphere is less only a third of the equatorial value.

L. C. W. BONACINA

RIVERS AND MAN. By ROBERT BRITTAIN. *London: Longmans*, 1959. $8\frac{1}{4} \times 5\frac{1}{2}$ *inches; 288 pages; maps and plates. 21s*

This is a study of relationships between rivers and man in terms of ideological concepts. Mr. Brittain personalizes a collective concept of mankind striving through the ages to perfect his relationship with river-kind, while the latter cooperates or resists according to the circumstances of the relationship. Man has to drink; he ponders the problem of how to establish a relationship which will connect the thirst-slaking attributes of rivers with his need. He cups his hands, then invents a bucket, a rope and pulley, a chain bucket. Man needs to eat; he searches for a relationship between rivers and the seeds he plants, and invents means of expressing it—irrigation ditches, dams, wells and the like. Man seeks to transport things from one place to another; he observes that rivers offer floatability, and that by rafts and boats he can establish a relationship which will solve his problem. Man's opportunity for advancement is limited by the strength of his muscles and those of the animals he has domesticated; he notes that there is force in the flow of water, and invents the water-wheel to complete the relationship between the power of water and the miller's stone. This is the great revolutionary advance. Rivers are ready and willing to lend their strength to his elbow, to cooperate in developing this new relationship and the possibilities of social advance which now open out before the partners. But the time is not yet ripe, for the secret of power from water is "discreetly kept by politicians, businessmen and all others who had a stake in the prevailing economy." The imperial Roman Luddite reactionaries suppressed the revolutionary invention lest the slaves might see an end to slavery.

This moral crisis in the relations between rivers and man took place, Mr. Brittain thinks, a few decades before the Christian era. Mankind had to wait another two millennia, till the Tennessee Valley Authority revealed the full blossoming of man's relationships with rivers through the theory of the balanced and integrated basin-concept. As a matter of fact, man was waiting for a lot of other things besides abstract concepts and thought-patterns of relationships—for the discovery that $v^2 = \sqrt{2gh}$, for steel to make sluice-gates and reinforced concrete, for water-turbines, electricity, bulldozers and pneumatic drills. But these earthy matters have no place in Mr. Brittain's poetic imagery.

M. G. IONIDES

DAS BILD DER WÜSTE. By ALFONS GABRIEL. *Vienna: Adolf Holzhausens*, 1958. $10 \times 7\frac{1}{2}$ *inches; 296 pages; maps and photographs. 47s*

Over the last thirty years Alfons Gabriel has been on several expeditions to the deserts of North Africa and Persia. His book is intended for the general reader and is written in a clear and lively style. The first half deals with deserts in general; their physical make-up, flora, fauna and peoples. The camel is given a chapter to itself because the author considers that this animal has been woefully neglected or misrepresented in the existing literature. Motor transport receives less attention, and this is in accordance with the somewhat romantic image of the desert that the book presents. The

second half consists of an anthology (if the word can be used in this context): a collection of eleven extracts from the writings of travellers in Asian and North African deserts. Four of these are by Gabriel himself, while others have been freely translated from the French of Théodore Monod and the English of Lady Anne Blunt, Rosita Forbes and H. St.J. B. Philby. There are also two extracts from Sven Hedin to whom the volume is dedicated. The photographs, of which there are more than thirty, are all excellent; the maps are simple route maps and evidently intended to be used in conjunction with an atlas.

CONRAD AUB AND A. T. GROVE

LES OCÉANS. By JULES ROUCH. *Paris: Armand Colin*, 1957. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches;* 216 *pages; diagrams. No price*

This is another publication from the now extensive Collection Armand Colin, which is an inexpensive paper-backed series designed to interest student and layman in many of the problems of science, philosophy, history, and literature. The format is similar to the British "Pelican" books and, like these, this volume contains in a small space a considerable amount of information conveniently and concisely assembled. The volume is written in three parts and in the first of these the main methods used in studying the physical properties of the oceans are outlined. The chapters deal with how to record or measure: ocean depth; the material of the ocean floor; ocean temperature, chemical composition, and optical properties; together with movements of the sea, and also the occurrence of ice in its various forms. In the second part, which forms a little over half of the work, the author discusses the main results derived from the observations which have been carried out in the different ocean basins of the world and he follows, chapter for chapter, the plan of part one. The final part contains a brief indication of some of the practical applications of this information in the spheres of navigation, meteorology, naval operations, fishing, and industry. This logical presentation is to be commended not only academically, but also as having the advantage of capturing the interest of the general reader in the practical problems of oceanographic investigations before plunging him into what could otherwise have been a rather dull catalogue of the physical properties of the oceans. It is only unfortunate that the inclusion of this work in a series of volumes devoted to physics has precluded any discussion of the biology of the oceans which is so inextricably bound up with the physical environment. While regretting this the geographer will nevertheless find in this volume an unpretentious, but very useful, elementary text.

G. E. GROOM

CONSERVATION OF NATURAL RESOURCES. Edited by GUY-HAROLD SMITH. *New York: John Wiley; London: Chapman and Hall*, 1958. $7\frac{1}{2} \times 10$ *inches;* 474 *pages; maps, tables, diagrams, photographs.* 68*s*

THE CONSERVATION OF NATURAL RESOURCES. By R. C. HAW. *London: Faber and Faber*, 1959. $8\frac{3}{4} \times 5\frac{1}{2}$ *inches*; 256 *pages; photographs, diagrams and tables.* 30*s*

The subject with which these books are concerned is, of course, so vast that what is to be included, and intelligently discussed, in a single volume is inevitably a matter of selection. The first avoids the pitfall of claiming to cover the whole subject by not attempting rigidly to define the subject, and the same wisdom is apparent in the editor's avoidance of overall titles for the eight parts into which it is divided. The readers primarily aimed at are evidently American High School and university students, but it should prove equally useful to general readers who seek a well balanced and attractively produced guide to what "Conservation" is all about, and why it is increasingly the concern of all citizens, now that the days of extensive exploitation are numbered. The book was first published in 1950, and this second, and revised, edition appeared towards the end of 1958.

In spite of the similarity of title, R. C. Haw's book is very different from that edited by Guy-Harold Smith. As is stated in Chapter I, it has been written for "agricultural

students, teachers, farmers and interested townspeople everywhere," and the accent is on practical work, so that it is to those whose daily work is on the land that the book is primarily directed. Nevertheless, the book is for any reader an excellent introduction to conservation problems in arid and semi-arid Africa, particularly southern Africa, the author being an instructor in soil and water conservation at the Dombashawa Government School in Southern Rhodesia. The approach is primarily that of people interested in the prevention of erosion, which is the most obvious manifestation of the conservation problem in that part of Africa with which the author is concerned.

Although practical—perhaps *because* practical!—the book is written with a sense of mission, and therefore rather unduly colourful phrases, such as the description of Figure 6 as showing "Finger erosion grasping at the earth's vitals," may be excused. Some over-generalizations are not so readily excused, even though they are very difficult to avoid in writing a book of this kind. The sentence in chapter III: "Trees have a moderating effect on the climate, and their destruction, therefore, leads to greater extremes of temperature, and to increased evaporation where soil is exposed" may be true if certain caveats are borne in mind, but one can imagine the danger of an unlearned person getting this phrase into his head, and acting on it in all circumstances!

The majority of readers of this *Journal* will find this an excellent book for getting the feel of one of the most widespread problems which South Africa and Rhodesia have to cope with.

F. H. W. GREEN

GEOGRAPHY OF COMMODITY PRODUCTION. By RICHARD M. HIGHSMITH and J. GRANVILLE JENSEN. *Chicago: J. P. Lippincott*, 1958. 10×7 *inches;* 462 *pages; maps, diagrams and photographs. No price*

A list of the "commodity geographies" published in the U.S.A. would be a long one. This new addition to their number adheres to a standard arrangement. There are four parts (on agriculture, fishing and forestry, mining and manufacturing) and each is introduced by a chapter analysing "the general factors which influence production." A strict commodity approach is followed and the reader is guided remorselessly from the section on wheat (p. 22) to that on "malt beverages" (p. 438) where the book concludes with the sentence: "The United States alone produces a third of the world output."

Some of the particular sections, for example that on aluminium, are good, accurate summaries, while the account of Western Hemisphere production is full and up-to-date throughout. A serious weakness is the inadequate and sometimes inaccurate treatment of Europe. There is vagueness about distance and area. Lorraine ores are said to "have the advantage of . . . a location close to excellent coals" (p. 285); the Black Country is treated as synonymous with the Midlands (p. 366); there is the assertion that "the major iron formations extend along the eastern flank of the Pennine Chain from the Cleveland Hills in the northeast to Weymouth on the English Channel" (p. 286). Some statements, though not exactly wrong, are quite misleading; for example, "Metropolitan London . . . produces diversified manufactures ranging from ships and chemicals to textiles" (p. 366).

The book has, nonetheless, much to commend it. There is awareness of the complexity of factors influencing the distribution of production, photographs are well-chosen and ample, and tables are clear. The writers appear, too, to have worked diligently to perfect their accounts of technology and mineral geology. The occasional howlers, however, are disconcerting: "The Bessemer steel converter . . . is not able to utilize . . . pig iron made from ore containing phosphorus" (p. 294). The student of geography in Britain will tend to use a comprehensive book of this kind as a work of reference. For this purpose Zimmermann's 'World resources and industries' is more reliable and to be preferred.

J. E. MARTIN

SURVEY AND CARTOGRAPHY

AERIAL PHOTOGRAPHY AND MAP-MAKING. By L. HURAULT, Inspecteur Général Géographe, Hon. Director of the Institut Géographique National (English translation). *Paris: Institut du Transport Aérien*, [1959]. $10^{1}/_{2} \times 8^{1}/_{4}$ *inches;* 112 *pages; maps. No price*

At first sight this appears to be a book without a purpose. There is, in the introduction, no indication of the audience for whom it is intended. The scope of the work is described as "an account of what highly developed countries need by way of maps . . . an outline of the general ideas behind cartographic programmes showing the part which aerial photography can play . . . to describe how maps are made from aerial photographs . . . in conclusion, some indication is given of the material means at the disposal of organizations in charge of this work." It is not until page 35 that the object of such an essay may be inferred from the statement that "Public opinion should be educated and used . . . to see that topographical and cartographic work is given its due place in the general economy . . ." The scope outlined is too great for the space devoted to it and in the early sections, dealing with map needs and catographic programmes, over-compression has led to triteness and lack of precision. There is no recognition of the very great advantages of conformal projections for topographical maps, nor does the discussion of scale ranges face the dilemma that whilst a decimal range is neat and tidy on paper, utility requires maps ranged in scales at steps of about four times enlargement or reduction.

The second half of the book, dealing with aerial photogrammetry, makes up for any shortcomings in the first half. It is, in effect, a summary of the aerial photogrammetric methods employed by the Institut Géographique National; of the actual map series under production there; of the resources employed and the out-turn achieved; and of the relative costs of each operation on several of the map series. There are many fascinating, and some amazing, facts recorded and a number of points which could have been elaborated to great advantage. But the outstanding fact which emerges is the immense economy and tremendous efficiency resulting from the concentration of aerial photogrammetry into one large and well-organized undertaking.

The Institut Géographique National is responsible for all topographical work of importance required by official organizations and public or subsidized companies in French territory at home or overseas. It has its own training establishment and its staff number over two thousand, of whom about one thousand are technical staff (surveyors, cartographers and air photographic personnel) whilst it operates about one hundred first- and second-order stereoplotting machines. Table 8 on page 101 shows that the adoption of aerial photogrammetry has reduced the cost of surveying on the 1/20,000 scale in France to 40 per cent. of the cost of plane-tabling and on the 1/50,000 scale in North Africa to 60 per cent. of the plane-tabling cost. These are impressive reductions, probably only realizable when very large areas can be undertaken in bulk in such an organization.

The latter part of the book should be of the greatest value to anyone studying modern original cartographic methods, in particular the selection of air photo scales and air photo compilation methods, with their associated accuracies and costs, with the one exception of compilation by the Multiplex method. It will have a lasting value as a thoroughly reliable and possibly unique source of cartographic statistics covering the last fifteen years.

The book is excellently illustrated. The letterpress is lithographed from typescript at full scale, giving long unjustified lines of $6^{3}/_{4}$ inches which, with narrow margins, do not make for ease in reading. There is no indication of the date of completion which is a pity, as there are a few expressions of opinion "at the moment" (p. 56) and "as yet" (p. 57) for which a date is important. The latest work mentioned is dated 1956; other evidence suggests 1957 or early 1958 for the date. D. R. CRONE

AN OUTLINE OF PHOTOGRAMMETRY. By K. SCHWIDEFSKY. Translated by JOHN FOSBERRY. *London: Pitman*, 1959. 9×6 *inches;* 326 *pages; plates and maps.* 60*s.*

The first German edition of this book was published in 1936 and, since that year, the successive editions of Schwidefsky have become one of the standard text-books on the subject. The present translation is based upon the 6th German edition of 1954. Thus it includes brief mention of the Thompson-Watts plotter, but antedates the introduction of electronic printing techniques and the development in the U.S.A. of stereotemplet triangulation. About 200 pages are devoted to the well-worn paths of the general text-books on the subject. The weakest section is that describing "Plotting aerial photographs with simple equipment." For example, the objectionable orientation of a pair of photographs under a stereoscope by rotating them about pins thrust through the principal points is the only method described. This can be guaranteed to render the prints useless for any subsequent graphical plotting. Although the Arundel Method receives some rather grudging praise, the description of the methods used or the problems encountered in radial line plotting is most inadequate. In contrast, such minor diversions as the determination of the heights of trees from the lengths of their shadows receive elaborate treatment.

Schwidefsky's attitude to simple equipment is, however, largely summed up in his remark: "In the large map-making factories of the United States various types of simple angle-measuring and tracing instruments are used by semi-skilled personnel for mass-production purposes. The organization of this work exhibits the well-known characteristics typical of large-scale industrial mass production."

The real core of the subject, to him, is the plotting from aerial photographs by means of first- and second-order plotting machines. The long chapter entitled "Stereophotogrammetry," comprising nearly one-third of the book, is the really important contribution which the author has to make. The only equivalent treatment, in English, is Miskin's translation of Zeller, which is, of course, almost entirely confined to the study of Wild instruments. Although Schwidefsky naturally devoted much space to the description of Zeiss equipment, there is a most valuable comparative study of the principal German, Swiss, Italian and French instruments. There is a good elementary introduction to the principles of aerial triangulation. The lucid analyses of the propagation of errors in instrument orientation and the propagation and adjustment of errors in aerial triangulation are most welcome.

DEREK MALING

LANDSCAPE FROM THE AIR. By F. J. MONKHOUSE. *Cambridge: University Press*, 1959. 10×7¼ *inches;* ix+53 *pages; oblique air photographs.* 8*s*

The sub-title of this book is "A physical geography in oblique air photographs," and it is primarily intended for Sixth Form geography students. They should find it extremely useful for, as the author tells us in the preface, nine of the photographs have already been set in Advanced Level and Overseas H.S.C. examinations. More than half of the 52 photographs were taken by Dr. St. Joseph, Curator in Aerial Photography at Cambridge, and the rest are from the library of Aerofilms, Ltd. Glaciated country and coasts are well suited to this type of representation, and many striking examples are given of these and other land forms. A brief description of each photograph is followed by a longer analysis and a list of other examples of the type of land form depicted. The written commentary is much more valuable than that in the very ambitious French 'Relief form atlas.' References are given to individual points on photographs by a simple coordinate system, and also to the appropriate topographical maps. The picture of Rough Tor on Bodmin Moor is perhaps the least successful in the collection; on the page facing it Ingleborough, given as an example of a monadnock, bears little resemblance to the Appalachian original, but Professor Monkhouse cannot be blamed for that. On page 25 it might have been made clearer

that the recent retreat of the Rhône Glacier follows a "little ice age" and is not from a glacial maximum. There are no photographs of braided rivers, polar regions or (except for a coral island) inter-tropical landscapes. Nevertheless, at eight shillings, this book is good value. A. T. GROVE

IMAGO MUNDI: Vol. XIV. *The Hague: Mouton and Co.*, 1959 (*London Agents: Henry Stevens, Son and Stiles, 39 Great Russell St., W.C.* 1). 11½×8½ *inches; 126 pages; maps and plates. 72s*

The fourteenth issue of the cartographical review *Imago Mundi* is dedicated to its founder and former editor Leo Bagrow, who died at The Hague in 1957. The publishers have been assisted in preparing the present, necessarily delayed, volume by Captain Roukema of Amersfoort and Mr. R. A. Skelton of the British Museum. The obituary notice of Leo Semenovich Bagrov (to give him his Russian name) is followed by that of another notable and valued contributor to the history of cartography, Johannes Keuning. Both men were born in 1881, and the latter spent most of his life as schoolmaster and lecturer, devoting himself to maps after his retirement. Bagrow as a young man was in the service of the Hydrographic Department of the Russian Navy. He thus possessed a knowledge of maps which was soundly based on mathematics and survey. After the October Revolution he settled in Berlin, only to be uprooted a second time by the late War. He then withdrew to Stockholm where he found generous patronage from the Crown Prince, now King Gustav VI. The bibliography of his publications covers a period from 1912 to 1959, and among the seventy-three items many readers (like the present reviewer) will perhaps treasure most the monograph 'A. Ortelii Catalogus Cartographorum' which appeared in 1930, and is an invaluable work of reference.

The new *Imago Mundi* contains a careful discussion of the debatable authorship of some of the maps in Ptolemy's 'Geography,' and an analysis by Captain Roukema of the significance of certain place-names and details on the La Cosa map. Unfortunately those who do not possess a facsimile of the map will find his paper difficult to follow, and two accompanying sketch-maps, devoid as they are of network or scale, are unhelpful. The writer makes a useful commentary on "losing the pole star," which occurs for all practical purposes within 9° or 10° of the equator, a fact glossed by the layman (*e.g.* Peter Martyr) as meaning that a ship has crossed the line. He makes use, however, of the expression "islands and mainland" as though this must be taken literally. The same mistake is made by writers seeking to determine the objective of Columbus. It is impossible often to distinguish the two categories of land on voyages of discovery, and the indeterminate phrase was commonly used to cover all contingencies.

As usual, the lavish and beautifully reproduced plates will delight the connoisseur. There is, for example, a fine panorama of the Sack of Rome in 1527, which its recent purchaser, M. Destombes, assigns to Peter Bruegel the Elder, *c.* 1551. It is here reproduced for the first time, together with a sketch key. The late J. Keuning is represented by another of his studies of the great Dutch atlas-makers, in this case W. J. Blaeu. In quite another field falls the article, "Mr. Jefferson makes a map," by Coolie Verner. The 'Map of Virginia' 1786 was designed to accompany a French version of the author's 'Notes on the State of Virginia,' and we are taken behind the scenes to observe the business side of map-making, with all its unexpected expenses, frustrations and delays. The plate had to be engraved in London, where Faden of Charing Cross was then the leading geographical tradesman. Also worth attention is the large map of Chile (1646), described by Lawrence C. Wroth, which crossed the Atlantic from the Huth Collection in 1917. It was bound into Father Ovalle's 'Historica Relacion del Reyno de Chile' and is especially interesting for its numerous pictorial and textual insets. The smaller map which usually accompanies this book was, Mr. Wroth considers, a hastily made and rather poor derivative.

The useful chronicle and general bibliography should not be overlooked by map-lovers. E. G. R. TAYLOR

TRAVEL AND EXPLORATION

THE CARAVELS OF CHRIST. By GILBERT RENAULT. Translated by RICHMOND HILL. *London: George Allen and Unwin*, 1959. $8\frac{1}{2} \times 6$ *inches;* 261 *pp.; plates, sketch maps and figures.* 25*s*

The "Caravels of Christ" are the vessels in which the Portuguese navigators pioneered the sea route to India via the Cape of Good Hope. The importance for modern history of the arrival of the Portuguese off Calicut in May 1498 does not require to be emphasized. This book gives a spirited account for the general reader of the course of events leading to this, from the inception of Portuguese overseas expansion early in the fifteenth century under the direction of Prince Henry the Navigator, and recounts in detail the relations between Vasco da Gama and the rulers of Calicut and Cananor, which were the prelude to a new era in the history of Asia. The author considers that the whole movement was consciously planned from the beginning, though it is arguable whether the "Plan of the Indies" was "conceived in its entirety by Prince Henry." Portuguese chroniclers have left lively and picturesque accounts of their countrymen's achievements, and the author draws largely on extensive quotations from them, translated direct from the Portuguese. It is, to a considerable extent, therefore, in the words of contemporaries or near contemporaries, that the attainment of the Indies is presented to the reader. The author also considers the voyages in their political and international setting, and briefly in relation to the cosmographical ideas of the day. The treatment of Portuguese navigational science is rather inadequate; the problems confronting the navigators on these pioneer voyages are not made clear. They would not have found in Zacuto's 'Almanach perpetuum' "all the charts required for navigation." "Latitude" is an error for "longitude" on p. 129, and there are some errors, mainly verbal, which might have been noticed in proof. The translation reads easily. Though there are some sectional maps, there is no comprehensive map of the route as a whole. G. R. CRONE

BOTANICAL EXPLORATION TO THE TIME OF LINNAEUS. By WILLIAM T. STEARN. *Proc. Linn. Soc. Lond.*, 169 *Session*, 1956–57. *pp.* 173–196

The 250th anniversary of the birth of Carl Linnaeus provided a fitting occasion for a glance at certain geographical aspects of his career (*Geogr. J.* **123** (1958), p. 510) but no mention was made of the botanical explorations of his predecessors. The present article is a useful summary of this subject starting with the ancient Greeks, for Theophrastus's work 'The enquiry into plants,' contains the results of botanical exploration carried out during Alexander the Great's military expedition into Asia, 331–321 B.C. The full reports transmitted to Athens have been lost but the remnants preserved in the writings of Theophrastus show their importance. After this promising start, interest in the subject was not reborn until the sixteenth century, when a number of botanical works were published, mainly in Central Europe, from London and the Netherlands down to Italy, and also one in Salamanca.

A map of botanical exploration before 1732 shows that, although the areas covered were small and the men comparatively few, collections had been made from lands as remote as Japan, coastal China, the Philippines, Ceylon, southern India, the Cape of Good Hope, Brazil, Chile, Peru, Jamaica, Virginia and eastern Canada. Most of the early travellers were either physicians or priests interested primarily in medicinal plants and the author refers to some of the more important of them. E. HINDLE

MISCELLANEOUS

TRANSACTIONS OF THE INSTITUTE OF BRITISH GEOGRAPHERS. Publication No. 25. Edited by R. W. Steel. *London: George Philip*, 1958. 10×7 *inches;* 253 *pages; maps, diagrams.* 40*s.*

The volume of papers published by the Institute of British Geographers in 1958 contains 16 papers. Seven of these are geomorphological, a departure from a policy of

keeping balanced contents. Unfortunately, the imposition of a theoretical balance had led to an accumulation of papers on geomorphology, but now that these are published we may expect a more practical balance reflecting the very varied interests of the Institute's members.

It is encouraging to see that the majority of the papers are additions to the literature of our own country. Some of these are wide in scope, such as S. Gregory on the importance of the uplands in the water supply of this country. F. A. Barnes has a paper on milk production, tracing the changes in the pattern of production over the last thirty years. This is a long and detailed paper, particularly when it is considered that his twenty-one maps inevitably receive only brief comment in the text. The Presidential Address by Professor R. H. Kinvig is a survey of the changing relationship between the Isle of Man and the rest of Atlantic Britain and the unchanging importance of the highland-lowland divisions within the island. Shorter papers deal with the urban morphology of Birmingham and Aberystwyth, while D. J. M. Hooson contributes an up-to-date survey of population changes in Hertfordshire. The expansion of London has now transformed this county and the resulting competition for land in the south-west is reminiscent of earlier experience in south-west Middlesex. It is a pity that one of Dr. Hooson's maps differs in orientation from the others, while his map of soil categories is so badly generalized as to be misleading. B. L. C. Johnson writes on the West Midland conurbation, grouping the confidential returns of the Factory Inspectorate by kilometre squares, and so producing a series of maps that may be published.

Two of the geomorphology papers are useful additions to the denudation chronology of the British Isles: E. C. F. Bird on the High Weald and E. M. Driscoll on the Vale of Glamorgan. There is a detailed account of the coast around Morecambe Bay by R. K. Gresswell and a well-presented account by J. B. Sissons of the deglaciation of part of East Lothian. A welcome paper by Miss A. Coleman describes the antecedent gorge on the River Salzach, Austria; the evidence for antecedence is described and analysed extremely well. G. H. Dury has a paper on valley meanders, testing his theories against several Midland streams. This paper along with one or two others in the present volume aroused an important discussion when it was read, but this is not printed here. This omission is serious enough in these cases, but it becomes ridiculous when, as in the past, contributions intended as the basis for discussion are published in isolation and without comments. A good example of this is the recent paper by A. F. Martin on "Determinism," published without either the discussion it initiated or even one or more contributions by those who disagreed with him. On this matter the Institute is either not taking its duties seriously enough, or is taking them a little too seriously.

This volume also includes a characteristic survey of recent trends in geomorphology by Professor Wooldridge, and two other papers of theoretical interest that again aroused discussion but here appear without it. I. S. Maxwell reconstructs the vegetation of Roseland (Cornwall) by using place-name evidence to establish the varying altitude of the former woodland-moorland boundary. Finally, there is a short thoughtful paper by E. M. Rawstron on industrial location. He argues that, for the geographer, location theory is most likely to be of practical value if it considers marginal rather than ideal locations.

K. M. CLAYTON

GEOGRAPHY OF WORLD AFFAIRS. By J. P. COLE. *Harmondsworth: Penguin Books*, 1959. 7×4 *inches;* 346 *pages; map.* 3*s* 6*d*

Dr. Cole of the University of Nottingham here provides a fresh, readable and well informed assessment of the geographical background of world politics, illustrated by numerous maps and diagrams, together with a copious selected reading list and an index mostly of places. 'Geography of world affairs' should make a wide appeal: in contrast to the school texts about the whole world which geographers occasionally write as introductions to "general geography," this work supplies a sound introduction

to current affairs and justifies the usefulness of the geographer's approach to the study of geopolitical complexities.

Part I of this book discusses the use of maps, the spread of European influence, world population and production, and the division of the world into major regions. Part II is concerned with the Communist States (with their third of mankind) and the continents of the Outer Zone, while the third part is directed to the Soviet Union, the United States and, more briefly, the United Kingdom. The author shares the common apprehension that the world faces the most momentous and dangerous situation in its history but is aware that the political challenge may well be diverted to the commercial sphere and to the problems of the underdeveloped lands. This book, which is not short, is remarkably packed with material of various kinds relevant to the shifting scene of international politics. The author's knowledge of Russian literature enables him to give due attention to the stature which the Soviet Union now assumes in the world. Not only the layman to whom this book is primarily addressed, but also the student of geography will derive interest and profit from the perusal of this book, which testifies to wide reading and to deep reflection. W. GORDON EAST

SHORTER NOTICES

THE NORFOLK WE LIVE IN, by P. W. Blake, J. Bull, A. R. Cartwright, A. Fitch, is a bold and successful experiment to provide a succinct, easily understandable account of the history and geography of Norfolk for the school children of the area as a background to courses in local studies (*Norwich, Jarrold*, 1958, 5*s* 6*d*). To this end it is lavishly illustrated with maps and diagrams simply but effectively drawn, and contains clear, readable topographical maps in full colour of Norfolk (5½ miles to an inch), and south-east England, together with a map of the solid geology. This book brings together much information not otherwise easily accessible, and the authors are to be congratulated on having achieved so much in so short a space. The price is astonishingly low. C. T. S.

* * *

Mrs. Barbara Mons and her husband set off for Hunza in February 1956 after receiving an encouraging reply from the Mir. They drove from Istanbul to Teheran via Damascus and Baghdad, and from Teheran to Rawalpindi via Isfahan, Yezd, Kerman and Quetta. This journey, which is pleasantly recounted in HIGH ROAD TO HUNZA (*Faber*, 1958, 18*s*) occupies nearly half the book. I would, however, doubt whether the country between Rutba and Ramadi could be called "real desert," since this conjures up a picture of a sea of sand instead of the stony waste which it really is. The journey from Rawalpindi to Gilgit was made by air, and then on by jeep to Sikanderabad, where they were met by the Mir of Hunza's men with ponies. They stayed as the guests of the Mir, and Mrs. Mons gives a very charming picture of the life of the people with details of their occupations and their way of life.

* * *

CLIMBING THE FISH'S TAIL (*Heinemann*, 1958, 18*s*) concerns Machapuchare in Nepal and is an account by Wilfred Noyce of how he and four companions made an attempt on this peak, nearly 23,000 feet in height. Despite all their skill they were baulked at the last, reaching to within 100–150 feet of the summit. They were much hindered by bad weather, but Mr. Noyce writes with humour of their difficulties and his story of how they got as far as they did will be of interest to all mountaineers. There are also some interesting details of the people they met and the problems to be dealt with by expeditions to Nepal. To make up for their failure in Machapuchare they tackled another peak in the Annapurna group. Even there the weather did not relent and as he says "it was a wet journey down, but it was the last. . . . In five days we had climbed our mountain 'at the first go.'" J. F. G.

* * *

Two recent books on the Nile make an entertaining contrast. THE TEARS OF ISIS (*Chatto and Windus*, 1959, 25*s*) is by Richard Carrington. Well put together, good-humoured and mildly informative, it is the account of a journey by road, rail and river up the Nile, from the mouth at Rosetta to where the river emerges from Lake Victoria at the Ripon Falls. Mr. Carrington is at his best in the longest and most spontaneous part of the book, the early chapters on Cairo, and on his Egyptian friends for whom he has an engaging sympathy and affection. Antiquities do not stir his imagination very much; neither more nor less, it would seem, than the engineering works of man. When he enters the wild country of the southern Sudan his rather perfunctory descriptions of Dinka and Nuer, Shilluk and Bari, may send readers back to the works of Samuel Baker, or to the reminiscences of some forgotten District Officer who has actually lived in this remote land and loved its interesting peoples.

FOUR THOUSAND MILES OF ADVENTURE (*Robert Hale*, 1959, 21*s*.) is written in a very different style. A spirited, ramshackle, and occasionally too long book, it recounts the journey of three young men, two Frenchmen and an American, down the Nile by canoe. The original project was to paddle all the way from the Kagera source to Rosetta, but shipwreck on the first day modified the plans, and it was not until the travellers reached Juba that they launched the three kayaks in earnest. The author, André Davy, and his friends Jean Laporte and John Goddard, achieved something of the viewpoint of the early travellers on the Nile. Skimming the surface at hippopotamus-eye level, shooting the cataracts, and living off the land, theirs was a unique experience, and a unique book has emerged. Douglas McKee's translation from the French conveys very well the author's alert and good-tempered personality. D. M.

* * *

Two books on Ethiopia, written in a popular style, are alike in including some good photographs and a number of factual mistakes. Mr. Pakenham has, however, added something to our knowledge of Ethiopia in THE MOUNTAINS OF RASSELAS (*Weidenfeld and Nicolson*, 1959, 21*s*). He set out to visit the three mountains said to have been used for the imprisonment of the princes of the blood: Debra Damo, Amba Geshen and Wahni. The sites of the first two have long been known and he ascended both. Wahni he located precisely for the first time and he flew over it, but found that a landslip had blocked the path to the summit. Acting on a suggestion made by Mr. Stephen Wright, who has helped so many travellers and scholars, he enquired after old churches in the region he calls Gint, generally known as Gaint. He was rewarded by discovering at Bethlehem a rectangular stone church disguised by a mud wall and a conical thatched roof of the usual kind. A detailed description and plan of this building would be of great interest. The book should not be neglected by anyone interested in Ethiopian architecture. There are some delightful line drawings from Ethiopian manuscripts by Susan Benson.

Mr. Rittlinger is the author of several travel books in German; ETHIOPIAN ADVENTURE (*Odhams*, 1959, 21*s*) is the first to appear in English. He and his wife, who has written some chapters, tried to sail down the Blue Nile in canoes. They embarked at Malka Dejen and seem to have abandoned the attempt at or near Balati ford because of the attacks of crocodiles on the canoes. They do not refer to Colonel Cheesman's important book which mentions the "unusual respect" accorded by his escort to the crocodiles near here. This is a very slight book. The translation is by Eva Wilson.

C. F. B.

* * *

Dr. Leslie H. Neatby's IN QUEST OF THE NORTH-WEST PASSAGE (*Constable*, 1958, 21*s*) is a spirited attempt to compress the history of three hundred years of Arctic exploration into two hundred pages and, within these limits, it is remarkably successful. It is addressed to a Canadian audience and the intention is to make known to Canadians the names and achievements of British explorers of their country, most of whom are

seemingly less known than their French counterparts. The only two exceptions, Hudson and Franklin, are, the author observes, "probably more indebted to the mystery of their deaths than to the solid achievement of their lives for the honour which posterity has done them." Starting with Frobisher, Dr. Neatby covers his ground in fourteen chapters and an epilogue, each chapter the account of either a single journey or a series of connected journeys, such as the Franklin search expeditions. One may not agree with his choice, and there may be some inaccuracies, but the narrative is vivid and the interest is sustained throughout. It is, perhaps, a measure of his success that one finishes each chapter stimulated to read more about the journey it describes. There are a few pleasant illustrations taken from contemporary material, and four maps. The maps are sadly below the standard of the rest of the book.

* * *

Four hundred years after the search for a North-west Passage began, a vessel of a type undreamed of by the early explorers made the passage from the Pacific Ocean to the Atlantic by a route that would certainly never have occurred to them. Between 1 and 5 August 1958 the U.S. atomic-powered submarine *Nautilus* crossed the Arctic basin under the ice from off Alaska to Spitsbergen, a distance submerged of 1830 miles. It was an achievement to grip the imagination and opens up a field of possibilities that defy it but, in NAUTILUS 90 NORTH (*Hodder & Stoughton*, 1959, 15*s*), the submarine's captain, Commander William R. Anderson, and Clay Blair Jr. have failed to rise to the occasion. However, the facts are there—of the reconnaissance voyage in June 1958 as well as the successful voyage two months later—enough to show that such voyages are far from being routine exercises. There are a number of interesting photographs and two excellent end-maps of the routes of both the journeys. L. M. F.

* * *

Miss Margery Hinds has "had a quarter of a century's experience of teaching and held permanent positions in five different countries" and SCHOOL-HOUSE IN THE ARCTIC (*Geoffrey Bles*, 1958, 21*s*) concerns her experiences in the Canadian Arctic where she still lives. In the space of a few years she taught in three environments as different, one imagines, as could be found in those regions. She began at a school for Loucheux Indians at Fort Macpherson, Yukon Territory, and for a year broke herself in to Arctic ways amongst the most northerly of Indian tribes. Then on to an established Eskimo school at Port Harrison in northern Quebec and finally north to Cape Dorset, Baffin Island, to open her own school amongst Eskimoes who had had little contact with European influences. What gives distinction to her book, however, is the refreshingly adult outlook she brings to bear on all that she sees and hears and believes. Her opinions may not all be infallible but they are all worth recording, and she crowds an immense amount of interesting information into a small space. A. S.

* * *

Joyce Dunsheath's visit to the Caucasus in 1957, and her ascent of Mount Elbrus, were described in the *Journal* for March 1958. The fuller account contained in her GUEST OF THE SOVIETS (*Constable*, 1959, 21*s*) is very welcome, with its bold end-paper map and fine photographs, and the title is well-chosen to head a tale of friendship rather than one of purely climbing interest. Mrs. Dunsheath's ascent of Elbrus with Eugene Gippenreuter, her official Soviet guide, was an impressive feat, but the main interest of her book is in the description of Svanetia in remotest Georgia, which she visited on descending from Elbrus. A letter from her Svanetian friends, Joseph and Misha, each paragraph beginning "Oh! dear Mrs. Joyce Dunsheath!" fittingly closes a charming record of a kindly and unspoilt corner of Europe. D. M.

THE SOCIETY'S NEWS

BIRTHDAY HONOURS LIST

The Birthday Honours List includes the names of Douglas Laird Busk, British Ambassador at Helsinki (and recently Ambassador at Addis Ababa), who becomes a K.C.M.G.; Victor Martin Reeves Goodman, Clerk of the Parliaments, who becomes a K.C.B.; and Professor Charles Andrew Cotton, Victoria Medallist for 1951, and Emeritus Professor of Geology at Victoria University College, Wellington, N.Z., who becomes a Knight Bachelor.

AWARDS TO GEOGRAPHERS

On the occasion of the fiftieth anniversary of the Stockholm School of Economics (Handelshögskolan i Stockholm) His Majesty The King of Sweden approved the conferment of an Honorary Degree on Professor Dudley Stamp, Vice-President of this Society, for "Fundamental research in regional geography to the benefit of economic life and community planning." This is the first time that such an Honorary Doctorate has been conferred on a geographer.

Professor S. W. Wooldridge, former member of Council and Victoria Medallist for 1957, professor of geography, University of London King's College, has been elected a Fellow of the Royal Society.

NEW MEMBERS OF COUNCIL

At the Annual General Meeting of the Society on 15 June 1959 the following changes and elections to Council were made: The Baroness Ravensdale and Professor J. A. Steers become Vice-Presidents in place of The Rt. Hon. Lord Rennell of Rodd and Sir James Wordie. Sir Christopher Summerhayes replaces Sir George Binney as Trustee. Of the six new members of Council, three will serve for the first time; namely Mr. G. P. Pirie-Gordon, Lieutenant-General Sir Harold Redman and Professor M. J. Wise. Brigadier R. A. Bagnold, F.R.S., served on the Council from 1936–40 and again from 1947–52, Mr. Ian Cox from 1954–58 and Professor E. W. Gilbert from 1948–51 and again from 1954–6.

Of those who have not served before, Mr. Pirie-Gordon, who is a director of Glyn Mills, has served on the Committees of Management and Finance of the Trans-Antarctic Expedition, and of the British North Greenland Expedition. Lieutenant-General Sir Harold Redman, formerly Vice-C.I.G.S. and Governor of Gibraltar, is Secretary to the Isaac Wolfson Foundation. Professor M. J. Wise is professor of geography at the London School of Economics and a member of the Editorial Board and Council of the Geographical Association. Mr. Charles Evans, F.R.C.S., deputy leader of the Everest Expedition 1953, and at present Principal of the University College of North Wales, was also elected to the Council but for personal reasons is now unfortunately unable to serve.

GEOGRAPHICAL ESSAY PRIZE 1959, AND CONDITIONS FOR 1960

The Examiners have not recommended to the Council any award of the essay prize for 1959. In recent years the entries submitted for this Prize have been few in number, and it has therefore been decided to extend the closing date. A prize of £10 is now offered for the best geographical essay not exceeding 5000 words in length, including sketch-maps and diagrams, written by a student who is reading, or has read, geography at a university in Great Britain or Northern Ireland. Essays must be submitted before the end of the calendar year in which the student took his final examination. The closing date for entries for 1960 is therefore **31 December 1960.** The Council reserves the right to publish or retain for the Library any of the essays received.

GENERAL CERTIFICATE OF EDUCATION: GEOGRAPHY PRIZES

The Society's annual award of prizes for geography based on the results at Advanced and Scholarship levels in the General Certificate of Education summer examinations has been made, on the recommendations of the respective Boards of Examiners, as follows:

Oxford and Cambridge Schools Examination Board: P. W. Cave, King Edward VII School, Sheffield. *Oxford Local Examinations:* Peter J. Preston, Northampton Grammar School. *Southern Universities Joint Board for School Examinations:* Richard F. J. Chiplen, Sexey's School, Bruton. *University of London Examinations:* Ronald Urwick Cooke, Ashford Grammar School. *Joint Matriculation Board:* Philip Heyes, Canon Slade Grammar School, Bolton. *N. Ireland Senior Certificate Examinations:* Eileen E. Patton, Dalriada School, Ballymoney. *Welsh Joint Education Committee:* Anne Jones, Holywell Grammar School. *Cambridge Local Examinations:* Christabel Fraser, St. Helen's School, Northwood. *Durham University Examinations:* Derek Gowling, The Secondary School, Wolsingham.

APPLICATIONS FOR GRANTS FOR EXPLORATION AND RESEARCH 1960

Applications for grants for both exploration and research must reach the Director and Secretary not later than **22 February 1960**; it is only in very exceptional circumstances that later applications can be considered. Applications must be *typed* on the Society's own form which can be obtained on request; they must be accompanied by evidence of support from institutions or qualified individuals supporting the proposed expedition or research. Leaders of expeditions and other applicants for grants may be expected to attend an interviewing board.

As the result of recent discussion, the Council of the Society has decided that, whereas it cannot undertake to provide financial support for expeditions which have little or no geographical content, it is prepared to examine the plans of all such expeditions and to approve them or not as the case may be, from the point of view of planning, organization and technique.

APPEAL TO FELLOWS TO SUBSCRIBE UNDER COVENANT

Fellows who pay United Kingdom Income Tax at the full rate on any part of their income can greatly benefit the Society without any cost to themselves by covenanting to subscribe regularly for seven years. Fellows who covenant in respect of a sum which, after deduction of Income Tax at the standard rate, leaves at least the amount of the subscription are in the same position under the Bye-Laws as if they had paid a subscription of that amount in the ordinary way.

By virtue of its status as a Charity, however, the Society is able to reclaim the tax paid by a Fellow on the gross amount of the annual Covenant. The legal effect of the Covenant, in other words, is to make the amount represented by the annual payment the income of the Society and not that of the subscriber. The Society, being exempt from Income Tax, can therefore recover the tax paid on the subscription by the subscribing Fellow. In this way, for every actual annual amount of £4, paid by a Fellow under the Covenant, the Society will at the present (1959) rate of tax receive a total of £6 10*s* 7*d*.

The recovery of tax under Covenant will thus greatly assist the difficult financial position of the Society and all Fellows who are eligible to do so are therefore urged to complete a Deed of Covenant. Once the Deed of Covenant is signed, Fellows will be put to no additional cost and to no trouble beyond signing once a year a Certificate of Deduction of Tax which will be prepared and sent to them by the Society.

Covenanting in lieu of the ordinary subscription does not prevent Fellows paying the annual amount due by means of a Banker's Order. This method of payment is indeed greatly preferred. The date of the first payment, however, should not be earlier than the date of signing the Deed of Covenant.

The Covenant may also be used by Life Fellows or by any others who might wish to contribute to the general funds of the Society.

Please note

1. The date of the first payment must not be earlier than the date of signing the Deed of Covenant.
2. Those who are able to claim that Fellowship of the Society is a necessary expense of their profession or business, and so obtain relief from taxation on the amount of their subscription under Section 16 of the Finance Act, 1958, should *not* complete the Deed of Covenant unless they are prepared to forgo tax relief in future years.

THE RECORD

CONTRIBUTORS TO THIS ISSUE

Dr. Tom Harrisson, D.S.O., O.B.E., recipient of the Cuthbert Peek Award in 1932, has been since 1945 Ethnologist and Curator, Sarawak Museum, and is the foremost explorer of North Borneo. *Eric Shipton*, the distinguished mountaineer and traveller, was awarded the Gill Memorial in 1935 and the Patron's Medal in 1938. *Phillip G. Law*, Director of the Antarctic Division of the Department of External Affairs, has been in charge of Australia's Antarctic activities since January 1949 and has made numerous southern voyages as leader of the Australian National Antarctic Research Expeditions. *Dr. H. Lister*, lecturer in Polar studies in Durham University, was glaciologist with the British North Greenland Expedition 1952–54 and the Trans-Antarctic Expedition 1956–58; *Geoffrey Pratt*, employed by British Petroleum in their field-work and interpretation of findings, was lent by his Company to the Trans-Antarctic Expedition as geophysicist. *Dr. Cuchlaine A. M. King* is lecturer in geography at Nottingham University. *Dr. J. B. Whittow* is on the staff of the geography department, Makerere College, Uganda, and was deputy leader of the I.G.Y. Ruwenzori expeditions, 1957–58. *Dr. C. Kidson* is head of the Coastal Physiographic Section of the Nature Conservancy, and *A. P. Carr* is a member of the Section's staff. *C. W. Mitchell* is on the staff of Hunting Technical Services. *James H. Johnson* is lecturer in geography at University College, London. *C. Vita-Finzi* led the Cambridge expedition to the Puna de Atacama in 1958.

UNIVERSITY NEWS

University of Sheffield

The vacant chair of geography in the University of Sheffield has been filled by the appointment of Mr. C. A. Fisher, formerly reader in geography in the University of Leicester.

University of New England, New South Wales

Dr. Gilbert J. Butland, formerly of the department of geography in the University of Birmingham, has been appointed to the chair of geography in the University of New England, New South Wales, Australia.

University of Auckland

The removal of the department from the old army huts, occupied since its inauguration, into a new building has coincided with the completion of a number of long term research projects by staff members. The study of agriculture in Western Samoa and its physical and social environment, contributed to by all staff members, is soon to be published under the editorship of Professor K. B. Cumberland and Mr. J. W. Fox.

The investigation by Dr. L. Curry of the operation of the livestock industry of New Zealand in relation to its climatic parameters is completed and Mr. B. H. Farrell's study of the power resources of the country is nearing its end. The interest of Auckland in the islands of the South-west Pacific is being continued by Mr. R. G. Ward's work on Fiji, Mr. Farrell's forthcoming stay in the French West Pacific islands and Dr. Curry's recent period in New Caledonia. Mr. Ward has been at the University of London studying the historical geography of Fiji.

Visiting geographers of past years would be surprised how the diffidence with which they were shown around the department has gone. Professor D. L. Linton of Birmingham and Professor Hans Boesch of Zürich, both to visit Auckland shortly, will see how the comfortable, efficient facilities and new equipment are appreciated.

L. CURRY

ALEXANDER VON HUMBOLDT COMMEMORATION AND THE 32ND GERMAN GEOGRAPHICAL CONGRESS: WEST BERLIN

An international commemoration of the centenary of Alexander von Humboldt's death took place in West Berlin on May 18 and 19, under the sponsorship of the Humboldt Committee of the Federal Republic. The arrangements for the commemoration were admirably and most hospitably organized by the Gesellschaft für Erdkunde zu Berlin under the direction of its President, Professor J. H. Schultze. The commemoration was followed from May 20 to 24 by the 32nd German Geographical Congress, the first day of which was dedicated to the memory of Alexander von Humboldt and Carl Ritter, the two great founders of modern geography. These meetings gave the British delegates very welcome opportunities of discussion with a large number of geographers from the Federal Republic.

During the Humboldt celebrations the gold Humboldt Medal of the Gesellschaft für Erdkunde was presented to Professor Hermann Lautensach, of Stuttgart, for his extensive geographical researches, particularly in the field of regional geography; and also to Professor Carl Ortwin Sauer, of Berkeley, California, for his fundamental researches into the nature of the cultural landscape, and for his studies of the cultural landscape in North, Central and South America. At the Ritter commemoration during the German Geographical Congress the gold Carl Ritter Medal of the Gesellschaft für Erdkunde was presented to Professor Hans W:son Ahlmann of Stockholm, for his morphological and glaciological studies in the circumpolar regions; and also to Professor Carl Troll, University of Bonn, for his work on the physical geography of tropical mountains.

In the absence of the President, Lord Nathan, the Society was represented at the Humboldt Commemoration by Mr. L. P. Kirwan, the Director and Secretary. Other delegates from Great Britain included Mr. J. N. L. Baker (Oxford University) and Miss E. M. J. Campbell, Dr. K. Sinnhuber and Mr. T. H. Elkins (London University). The celebrations included a visit to the Mansion of Tegel where wreaths were laid on the burial place of Alexander and Wilhelm von Humboldt; the opening there of a Humboldt Memorial Exhibition; and, on the second day, addresses of welcome and tributes to Humboldt, followed by a memorial address by Professor Carl Troll on "Alexander von Humboldt's mission as a scholar."

To mark the Commemoration, the Gesellschaft für Erdkunde zu Berlin issued a memorial volume on Humboldt which is reviewed on pp. 405–6. An attractively illustrated life of Humboldt, 'Record of a life in pictures,' was also issued by Deutscher Kunstverlag.

L. P. KIRWAN

ALEXANDER VON HUMBOLDT COMMEMORATION AND GEOGRAPHICAL CONFERENCE: EAST GERMANY

The separate East German celebrations opened appropriately enough with a meeting at the Humboldt University in East Berlin, the name of which commemorates the services to science and learning of Alexander von Humboldt and his brother

Wilhelm. This meeting, attended by students and teachers of all faculties, was addressed by the professor of physical geography, Dr. F. Haefke, on Humboldt's importance in the development of geography.

The day of the actual centenary, 6 May 1959, opened with the laying of wreaths at the fine statue of Alexander von Humboldt which stands in front of the university in the Unter den Linden. The participants in the ceremony then moved across to the carefully restored State Opera House for the main official event, a commemorative address to the assembled scientists and other guests by Minister-Präsident Otto Grotewohl.

The foreign geographers taking part in the celebrations were then privileged to attend the annual conference of the "Geographische Gesellschaft in der Deutschen Demokratischen Republik," the society which unites East German university and school geographers. The meeting was held in the most pleasant surroundings of the Potsdam Pedagogic High School, an institution of university status which occupies part of the buildings of the New Palace in the park of Sans-Souci.

The first day of the conference was devoted to a continued discussion of Alexander von Humboldt's life and work, introduced by the President of the Society, Professor J. F. Gellert of Potsdam. Of particular interest was a tendency, especially evident in the contribution of Professor H. Sanke (Berlin), to present Humboldt not only in his familiar role as a physical geographer, but also as a neglected initiator in social and economic geography. In this connection, his scientific objectivity, his emphasis on the fundamental unity of all races, and his avoidance of the crude physical determinism favoured by some of his successors, were particularly emphasized. Among other contributions, mention must be made of an interesting factual account by the Soviet delegate, Professor Murzaev, of Humboldt's exploratory journey in Central Asia. Economic geography figured prominently in the remainder of the programme.

The celebrations continued with excursions to study physical and economic geography, with a formal meeting of the Academy of Sciences in East Berlin on May 14, and on May 20 with a celebration at the famous Mining Academy in Freiburg, where Alexander von Humboldt had studied. These occasions gave a most pleasant and valuable opportunity to meet geographers not only from East Germany but from all the Communist countries.

T. H. ELKINS

EXPEDITIONS IN THE FIELD DURING 1958

Two more reports have been received from expeditions whose plans were laid before the Research Committee in 1958 (see *Geogr. J.*, **124**, 2 (June 1958), p. 275). The reports are in the Library.

Cambridge University Expedition to Apollonia, 1958.—Nicholas Fleming was the leader of last summer's archaeological expedition to explore the submerged ruins of an ancient port and city off the Libyan coast. A complex of fish tanks (*piscina loculata*) was examined, and conclusions reached on the variation of sea levels since the last glaciation. Mr. Fleming gave an account of the expedition's work in a lecture to the Society on 13 April 1959.

Wye College Icelandic Expedition.—The final report of this expedition, led by Peter England, runs to 75 typewritten pages and includes maps, diagrams and photographs. The botany and geology of a stretch of country in north-west Iceland were studied, and many photographs taken. The report contains useful notes on practical matters for future expeditions.

Also received and deposited in the Library are four reports from the University of Durham Exploration Society: Switzerland, 1956; Lyngen Peninsula, Norway, 1956; Mauranger, Norway, 1958; Newfoundland, 1958.

THE MEETING OF THE BRITISH ASSOCIATION 1959

The 1959 meeting of the Association in York was attended by about 3000 members. Section E met in St. John's College where Canon Lamb, the Principal, and Mr. A.

Hurworth and Mr. R. O. Smith, joint local secretaries, had made excellent arrangements. The Section welcomed a distinguished group of guests and Professor Theo L. Hills represented the Canadian Association of Geographers.

The meetings of Section E opened on September 3 with papers on recent work in Yorkshire. Dr. H. C. K. Henderson, a contributor at the 1932 meeting in York, examined changes in the location of industry in West Riding since 1932. Mr. D. I. Scargill compared the West Yorkshire conurbation in the years 1851 and 1951, offering new arguments to account for the special characteristics of this conurbation. Mr. J. A. Patmore accounted for the development of Harrogate as an inland resort, and Mr. R. O. Smith, in a paper entitled "York and its geographical setting" assessed the changing influence of site and situation on the functional development of York. In the afternoon Mr. Smith led an excursion to examine the stages of growth of the city; meanwhile Mr. M. Kirk's party studied village settlement in the Vale of York.

The Section President, Professor K. C. Edwards, read his Address on September 4. Entitled "Trends in urban expansion," it traced the principal stages in the growth of towns, and examined the problems posed by the recent acceleration of town growth in many parts of the world. His address was given special point by Mr. G. Powell's paper on "The expansion of London," which demonstrated the strong forces making for further expansion of the metropolis and the need for a revised regional plan.

A joint session with Section K (Botany) on coastal erosion and protection was opened by Professor J. A. Steers. Contributors were Dr. M. C. Pearson on "The biology of the Sea Buckthorn," Mr. R. K. Gresswell on "Coast erosion and coast protection in Lancashire," Mr. C. Kidson on "The uses and limitations of vegetation in shore stabilization" and Mr. G. Cole on "The use of certain plants as stabilizers of marine sediments." The papers aroused considerable interest and prolonged discussion ensued. (See *Nature*, **184**, 4685 (1959) p. 499.)

High standards of leadership added to the interest of the week-end excursions. On September 5 Mr. G. de Boer led a party to study the north-east Yorkshire moors and Mr. G. C. Dickinson demonstrated problems of urban geography and planning in West Yorkshire. On Sunday Mr. Smith repeated his York excursion; Mr. G. R. J. Jones led a party to study the historical geography of the Yorkshire dales, while Mr. A. Harris outlined the features of the Vale of Pickering and North Holderness.

On Monday a special discussion on a problem of current geographical interest, that of world land use, took place.[1] Professor Stamp opened the symposium, followed by Mr. C. Board who gave the results of his South African survey. Mr. M. Brunt described methods employed in the Gambia survey, and Mr. W. D. Clayton examined problems involved in a vegetation survey of a tropical country, Nigeria. In the afternoon Mr. V. Robertson gave an illustrated account of a survey in Sudan, and Mr. R. G. Miller studied techniques of forest surveying. The following discussion included important contributions from Professor van Valkenburg and Professor Macdonald Holmes. In the evening the Section dinner was held at the Merchant Taylors' Hall.

Tuesday was made memorable by a brilliant centenary address from Professor Dr. C. Troll on "The work of Alexander von Humboldt and Carl Ritter," shortly to be printed in *The Advancement of Science*. Professor Stamp, in thanking Professor Troll, commented on the relative neglect in Britain of the study of the work of the great nineteenth century geographers. Later, Professor W. B. Fisher reviewed the widened scope of operations of the Tennessee Valley Authority, and Professor B. J. L. Berry described "Highway development and geographical change in U.S.A." Successful afternoon excursions included visits to the Howardian Hills (led by Dr. S. R. Eyre) and to the Yorkshire Wolds (Mr. de Boer), while Mr. J. Appleton led an "experimental" but highly successful excursion to study the railway geography of the York district.

The proceedings of the Section concluded on September 9. Dr. G. T. Warwick gave an illustrated paper on "Limestone regions of Britain," and Miss M. Bower indicated the results of her investigation on "Peat erosion in the Pennines." Mr.

[1] The papers given in this symposium are to appear shortly in *The Advancement of Science*.

Derbyshire described sub-arctic research at Knob Lake, Canada, and the final paper was by Mr. B. E. Coates on "Landscape parks of the West and East Ridings of Yorkshire."

The 1960 meeting of the Association will be held in Cardiff from August 31–September 7, when Professor E. G. Bowen will preside over Section E. Dr. Margaret Davies will act as honorary local secretary and Dr. J. W. Birch and Mr. N. Stephens will continue in office as Section secretaries. Offers of papers for reading at the Cardiff meeing will be welcomed, and should be made immediately to the Recorder, Professor M. J. Wise, London School of Economics, Houghton Street, Aldwych, London, W.C.2. M. J. WISE

GEOGRAPHICAL ASSOCIATION

The Geographical Association held its annual conference at the London School of Economics from 30 December 1958 to 2 January 1959, under the presidency of Professor R. O. Buchanan, whose presidential address was entitled "Some reflections on agricultural geography." At the joint meeting of the Society, the Association, and the Institute of British Geographers on 30 December in the Society's House, Lord Nathan, President of the R.G.S., was in the chair, and Dr. H. Lister spoke on the Antarctic snow and its climate. Professor Buchanan has been succeeded as president by Professor J. A. Steers of the University of Cambridge. The Association's spring conference was held in Leicester under the direction of Professor Norman Pye.

THE ST. LAWRENCE SEAWAY AND POWER PROJECT

The frontispiece to this number of the *Journal* shows the powerhouse structure which spans the St. Lawrence Seaway between the Canadian shore at Cornwall in the Province of Ontario and the United States shore at the eastern end of Barnhart Island, New York State. We publish this picture to commemorate the opening of this great international project by Her Majesty The Queen and by President Eisenhower on 26 June 1959. Readers of the *Journal* will remember that an article on the St. Lawrence Seaway and Power Project appeared in the issue for December 1953, written by the Hon. Lionel Chevrier, at that date Canadian Minister of Transport. Since then, a channel 2000 miles long with a minimum depth of 27 feet has been opened for sea-going vessels, from the head of the Great Lakes to the Atlantic Ocean, and a vast source of hydro-electric power has been harnessed in the International Rapids Section between Prescott and Cornwall; some 2,200,000 h.p. will be made available to be shared equally between Canada and the United States. The Hydro-Electric Power Commission of the Province of Ontario and the Power Authority of the State of New York are jointly responsible for the work in this key section of the seaway, and the powerhouses shown in our frontispiece merge at the international boundary between Canada and the United States.

G. A. WALLIN AND THE ROYAL GEOGRAPHICAL SOCIETY

The Library has received from Dr. W. R. Mead a reprint of his article on "G. A. Wallin and the Royal Geographical Society" (*Studia Orientalia, Helsinki*, **23**, 3 (1958). Wallin was a Finn who made two journeys to northern Nejd in 1845–6, for which he received one of the Society's Royal premiums in 1851. The article is based on letters in Swedish in the Society's archives, addressed to the R.G.S. Secretary, Dr. Norton Shaw. They refer to the Society's support of Wallin's work and the publication of his papers in the *Journal*, he being the first Finn to achieve this. As Dr. Mead points out, the letters "enlarge upon the known story, rather than contribute significantly new material," but they show the measure of understanding which Wallin developed with the Society; he writes of its "unwonted kindness towards northern peoples in general." Wallin's work is summarized in a paper by Mrs. M. Trautz in the *Geographical Journal*, **76** (1930), p. 248.

AN ENIGMATIC FRONTIER

The following note on a recent acquisition by the Society's archives has been contributed by General Sir James Marshall-Cornwall.

Mr. W. E. Jennings-Bramly has presented to the R.G.S. a collection of documents relating to the dispute over the Turco-Egyptian frontier, which brought Great Britain and Turkey to the brink of war in 1906.

This correspondence provides a useful source for those who are interested in the origin and delimitation of political boundaries. In fact, this particular boundary, which is today the accepted frontier between two hostile states—Israel and Egypt, has never, it appears, been established as an international frontier in any legal instrument.

In 1841, when Egypt was still a province of the Ottoman Empire, the Sultan issued a Firman confirming his Viceroy, Mehemet Ali, as hereditary ruler of Egypt. This Firman was accompanied by a map showing the eastern boundary of Egypt as a straight line drawn from El 'Arîsh to Suez; the Sinai Peninsula, east of this line, belonged partly to the Vilayet of the Hejaz, partly to the Governorate of Jerusalem, all Ottoman territory. Before the Suez Canal had been thought of, the Sinai Peninsula, almost waterless and inhabited only by a few nomad Bedouin tribes, was of scant political or commercial interest. Across it ran the Darb-el-Hag, the pilgrim camel track from Egypt to Mecca via 'Aqaba, and the policing of this route was recognized by Turkey as the responsibility of the Khedive's government, although it ran through Ottoman territory.

In March 1892, ten years after the British occupation of Egypt, the Sultan issued a Firman to the new Khedive, Abbas II, confirming to him, "the Khedivate of Egypt with the ancient boundaries indicated in the Imperial Firman of 1257 A.H. (A.D. 1841), as well as on the map annexed to the said Firman."

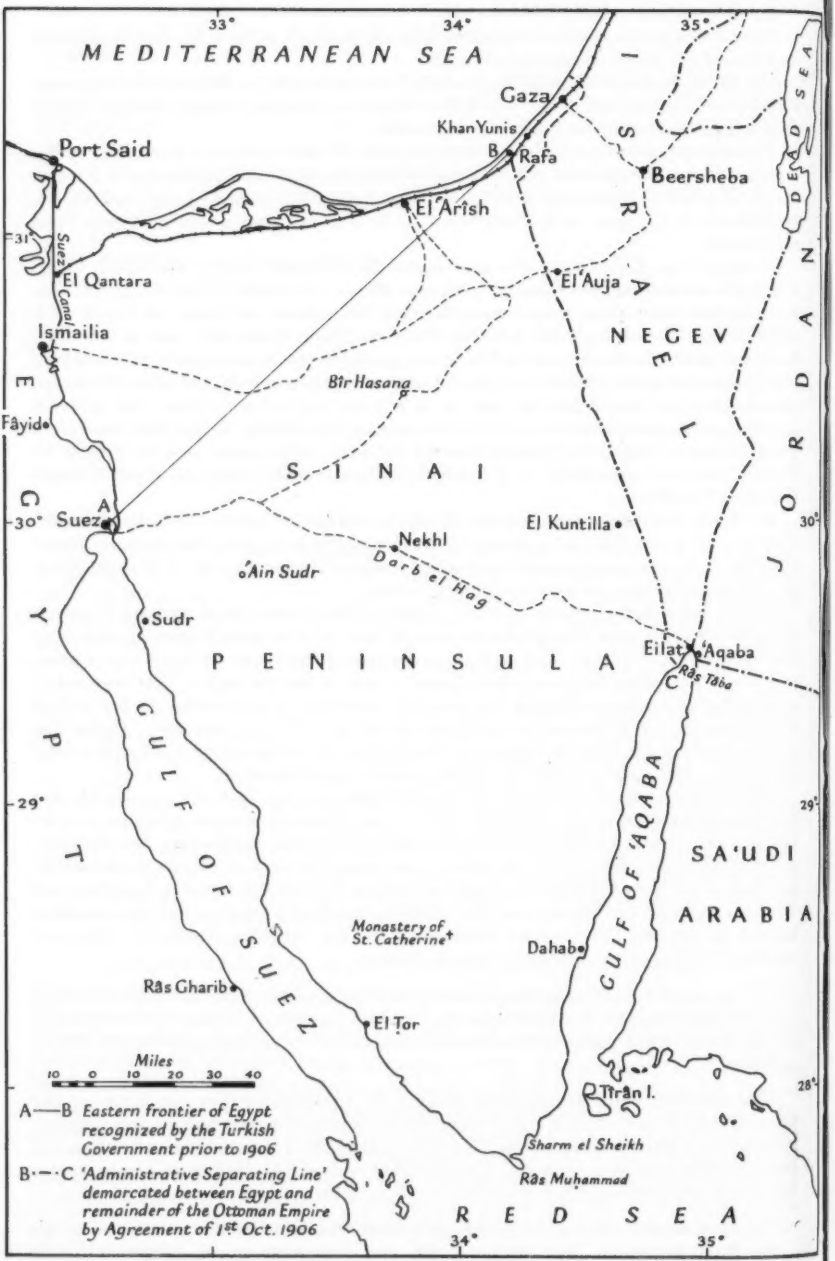
When this Firman arrived in Cairo, Lord Cromer saw that it implied Turkey's right to station troops throughout the greater part of the Sinai Peninsula, including the southern exit of the Suez Canal, and a heated exchange of diplomatic correspondence took place between Cairo, London and Constantinople. This resulted in a textual compromise, which at the time was accepted as satisfactory to the British Government. Lord Cromer claims ('Modern Egypt,' vol. 2, p. 269) that: "Under this arrangement, the frontier of Egypt was drawn from El 'Arîsh to the head of the Gulf of 'Aqaba. The incident was thus for the time being terminated."

This "arrangement," accepted by Lord Cromer and the British Government as a satisfactory solution of the question, was in fact a vaguely phrased telegram sent by the Turkish Grand Vizier to the Khedive on 8 April 1892, sanctioning the establishment of Egyptian police posts at certain points near the Gulf of 'Aqaba to protect the passage of the Holy Carpet from Cairo to Mecca. No frontier between Egyptian and Turkish territory was defined, and the telegram specifically refers to the "map of 1841, handed to the late Mehemet Ali Pasha, showing the Egyptian frontiers." The concluding sentence of the telegram reads as follows:

> ". . . as regards the Peninsula of Tor-Sinai, the *status quo* is maintained, and it will be administered by the Khedivate in the same manner as it was administered in the time of your grandfather, Ismail Pasha, and of your father, Mehemet Tewfik Pasha."

That meant that the arrangement was merely an administrative one for a specific purpose, and no new legal frontier was defined. There was thus no real documentary evidence that Turkey accepted the El 'Arîsh–'Aqaba line as an established frontier, and fresh trouble brewed up in 1905. This incident is described by Lord Cromer, somewhat cursorily and inaccurately in the following terms:

> "In 1905, another and more determined effort was made by the Sultan to occupy the Sinai Peninsula, but after a brief, and somewhat stormy negotiation, the


MEDITERRANEAN SEA
33°
34°
35°
Gaza
Khan Yunis
Rafa
Port Sid
Beersheba
El 'Arîsh
DEAD SEA
Suez Canal
El Qantara
El 'Auja
Ismailia
NEGEV
Bîr Hasana
Fâyid
SINAI
Suez
30°
El Kuntilla
Nekhl
'Ain Sudr
Darb el Ḥaj
Sudr
PENINSULA
Eilat
'Aqaba
Râs Ṭâba
GULF OF 'AQABA
29°
SA'UDI ARABIA
Monastery of St. Catherine
Dahab
Râs Gharib
GULF OF SUEZ
El Ṭor
Tîrân I.
Sharm el Sheikh
Râs Muḥammad
RED SEA
Miles
10 0 10 20 30 40
A—B Eastern frontier of Egypt recognized by the Turkish Government prior to 1906
B·—·C 'Administrative Separating Line' demarcated between Egypt and remainder of the Ottoman Empire by Agreement of 1st Oct. 1906

arrangement made in 1892 was confirmed. Shortly afterwards, the Turco-Egyptian frontier was delimited by a Joint Commission."

The documents recently handed over to the Society by Mr. W. E. Jennings-Bramly throw considerable light on the events of 1905/06—the so-called "Tâba crisis." Mr. Jennings-Bramly at that time was a Frontier Administration Officer with the title of Inspector, Sinai Peninsula.

Towards the end of 1905 the Ottoman Government occupied with Turkish troops the old fort of Tâba at the head of the Gulf of 'Aqaba, as they were legally entitled to do. Lord Cromer, however, detected in this action a possible threat to the Suez Canal and, at the beginning of January 1906, Mr. Jennings-Bramly was ordered to occupy the important tactical feature of the Naqb-el-'Aqaba (which commanded Tâba and the approaches from Egypt to the head of the Gulf of 'Aqaba) with a small detachment of Egyptian troops. These instructions he carried out, and later, on instructions from Cairo, even pushed forward an outpost to Marashash and the El-Beiar wells at the extreme north point of the Gulf.

On 12 January 1906, Sir Nicholas O'Conor, our Ambassador in Constantinople, received a letter from the Sultan complaining that "Colonel Bramly Bey" with Egyptian troops had camped close to 'Aqaba.

Lord Cromer then despatched a coastguard steamer to the head of the Gulf with supplies and reinforcements for Bramly, and this was replaced on 14 February by a gunboat, H.M.S. *Diana*. The Turkish commanding officer at 'Aqaba reacted strongly to these moves, and Bramly was forced to withdraw from his forward outpost.

It was obvious that trouble was bound to ensue, as nobody could say where the boundary was between Turkish- and Egyptian-administered territory. Diplomatic exchanges between London, Constantinople and Cairo became more acrimonious, the British authorities pressing for the immediate appointment of a "joint boundary commission to demarcate a frontier," the Turks protesting that a frontier demarcation was not necessary as all the territory in question was under Turkish sovereignty.

Finally, on April 30, Sir Edward Grey instructed Sir Nicholas O'Conor to "inform the Ottoman Government that ten days would be given them to comply with our demands, failing which the situation would become grave." Secret instructions were sent to Admiral Sir Charles Beresford to concentrate the Mediterranean Fleet at the Piraeus. Eventually, on May 14, the Ottoman Government agreed to evacuate Tâba and to appoint a joint commission to demarcate the eastern boundary of the Sinai Peninsula, roughly on a line from east of El 'Arîsh to west of 'Aqaba.

This boundary commission commenced work in June and the agreed boundary line was finally laid down in an "Agreement signed and exchanged at Rafah on 1 October 1906 between the Commissioners of the Turkish Sultanate and the Commissioners of the Egyptian Khediviate concerning the fixing of a *Separating Administrative Line* between the Vilayet of the Hejaz and the Governorate of Jerusalem and the Sinai Peninsula." (British and Foreign State Papers, Vol. 99, pp. 482–4.)

Thus the Turkish Government never admitted that an international frontier had been demarcated; the text of the Agreement referred throughout to an "administrative separating line."

On the other hand, the British and Egyptian authorities assumed the line to be an established frontier. The Egyptian Survey Department Paper No. 4 (Cairo, 1907), is entitled "A Report on the Delimitation of the Turco-Egyptian Boundary (June–Sept. 1906)." Lord Cromer in 'Modern Egypt' definitely states that "the Turco-Egyptian frontier was delimited by a Joint Commission."

Strangely enough, the Turkish authorities, having gained their point on paper, never pressed the matter further. The 'Karte des türkisch-ägyptischen Grenzgebietes,' 1:250,000, compiled in 1915 by the Map Department of the Prussian General Staff under instructions of the Turkish War Ministry, shows the Turco-Egyptian frontier according to the 1906 Agreement.

By the Treaty of Lausanne, 24 July 1923, Turkey renounced all rights and title to

the territories outside her newly established frontiers, and specifically renounced all rights and titles over Egypt and the Sudan as from 5 November 1914. The military occupation of Egypt by British forces was terminated by the Treaty of Alliance of 26 August 1936, and Art. 8 admitted the Suez Canal as "being an integral part of Egypt," but the 1 : 1M map illustrating the Treaty does not show any frontier in the Sinai Peninsula.

The somewhat negative attitude of the British Foreign Office to the whole question of the sovereignty of the Sinai Peninsula may be deduced from answers given in the House of Commons on 21 February 1951 ('Hansard,' Vol. 484, pp. 1263–4):—

Mr. Fitzroy Maclean asked the Secretary of State for Foreign Affairs what is the policy of H.M.G. with regard to the southern portion of the Sinai Peninsula, which under the agreement of 1906 remained part of Turkey and was taken from Turkey by British forces during the 1914–18 War, and has never been formally allocated to Egypt.

Mr. Ernest Davies: The grant of the right to administer this territory was confirmed by a firman issued by the Sultan of Turkey to the Khedive Abbas of Egypt on 8 May 1892 and was later enshrined in Notes exchanged between H.M.G. and the Turkish Government in May 1906. The eastern frontier of Egypt was never explicitly defined after the First World War, when Egypt became an independent kingdom and, by the Treaty of Lausanne, Turkey renounced all rights and titles to territories lying outside her frontiers. Egypt has, however, been in continuous occupation and possession of South Sinai ever since 1922. No Government has ever contested the fact that Egypt exercises effective sovereignty over this area.

Mr. Maclean: Is it not a fact that this area was taken away by us from Turkey, that it has never been given to Egypt and, therefore, belongs as much to us as to anybody else?

Mr. Davies: Prior to our taking it away from Turkey, it was administered by Egypt, and continued to be administered by Egypt following the Treaties of Peace after the 1914–18 War.

Mr. Maclean: Surely the mere fact of administration does not confer sovereignty.

It might thus be argued that the part of the Sinai Peninsula, bounded by the lines Rafa–Suez and Rafa–'Aqaba, is a territorial no man's land, the sovereignty over which is obscure; but this is a geographical problem which must be left to international lawyers.

JAMES MARSHALL-CORNWALL

MAP OF RUSSIAN CENTRAL ASIA AND KAZAKHSTAN

In the *Journal* for March 1958 (pp. 136–7), there was a note on the first sheet of a four-sheet map of Soviet Central Asia and Kazakhstan, published by the Central Asian Research Centre. The other three sheets have now been completed, and the set, folded in a cover with a glossary and gazetteer, can be obtained from Messrs. Luzac and Co. for two guineas, post free. The map, "edited and largely drawn by Colonel G. W. Gremmell, formerly of the Survey of India," is based on plates 53–4 of the 'Atlas Mira,' enlarged from the scale of 1:5M to 1:3.75M, approximately 60 miles to 1 inch, and brought up to date as far as possible. The general area covered extends from the Caspian Sea to the Takhla Makan desert in the east, and from the Aral Sea to the Himalaya in the south. The sheets have generous overlaps, so that they can conveniently be mounted as one map. For this purpose the sheets can be obtained, flat, for thirty-five shillings plus postage. The sheets are also complete in themselves, and can be purchased separately at ten shillings each.

All the names in Soviet territory on the basic map have been included and, with Russian descriptive terms, have been transliterated according to the rules of the Permanent Committee on Geographical Names. The glossary lists these terms, abbreviations or contractions used on the map, and their English equivalent, *e.g.* "kothovina, kot., basin"; "poluostrov, p-ov., peninsula." The gazetteer, using a

figure-letter reference system, includes every name printed on the map. The cross-referencing from place-names which have been changed during the Soviet regime to their new forms is a useful feature. Students of Russian Central Asia have now at their disposal a useful and attractive map.

CHANGING MEDIEVAL LANDSCAPE: A DUTCH STUDY

The geography of Europe during the Middle Ages has been the subject of several important studies published in the recent past. From Germany have come Oberbeck's researches on the south of the Lüneburger Heide and the Aller *Urstromtal*,[1] and the works of Jäger on later medieval changes in selected uplands of central and southern Germany[2]; France has produced an admirable survey of the geography of Comminges in the thirteenth and fourteenth centuries by Charles Higounet.[3] Out of the Netherlands has come one of the most detailed and substantial contributions—the two volumes of Dr. M. K. E. Gottschalk's 'Historische geografie van Westelijk Zeeuws-Vlaanderen,' which take the story of this area up to 1583. (No. 3 in Social Geografische Studies, edited by A. C. de Vooys for the University of Utrecht. *Assen: Van Gorcum*, 1955 and 1958.)

Westelijk Zeeuws-Vlaanderen is a coastal region in the south-west of the Netherlands and extreme north-west of Belgium, bordered by the Scheldt to the north, the Zwin to the west, to the south the dyke of Count John (Graaf Jansdijk), and to the east the line of an old watercourse, the Braakman; it is an area of silt deposits, covered in places by peat. This coastland was still open to the tides during the period of its first, Roman, settlement, which is witnessed to only by the scanty remains at Aardenburg. After the second Dunkirkian transgression in the fourth century, there is silence until place-names and charters of the eighth century reveal that small areas had been reoccupied as marshland sheep grazings, as sources of peat fuel, or even for tillage. The Viking invasion interrupted colonization for eighty years (840–922), but by the end of the tenth century the monasteries, which had figured in the earliest charters, had redevoted themselves to the task of wetland reclamation.

In the tenth century also came the third Dunkirkian trangression, to be followed by the first major change in the techniques of reclamation; the earliest penetration—small scale, uncoordinated, symbolized by artificial mounds on which the dwellings clustered—was now succeeded by the building of the first dykes around the inhabited areas. The *terpen* had only protected the buildings, but the dykes sheltered the land behind them also; moreover, outside the dykes, silt accumulated and the first "polder" name appears in the early twelfth century as a result. Within the dykes, the excavation of drains continued (the first *wateringues* appear in this area during the eleventh century) and the improvement in the drainage of the siltlands was followed by a conversion of many of the sheep grazings into arable land; the difficult peat soils remained largely untouched. By the twelfth century, although reclamation was still primarily a concern of large landowners, lay magnates had joined the ecclesiastical.

This region reached its peak of prosperity in the thirteenth century. The cloth industry flourished in the towns, their trade encouraged by membership of the growing Hanse and by the artificial improvement of their port outlets. The flatness of the terrain aided communication between the towns, both by road and waterway, and the food demands of an increasing population gave a stimulus to intensifying crop production and to the growth of orchards. The demand for land promoted the first reclamation of the peat lands for agricultural uses; hitherto they had been exploited solely for fuel. The monasteries led in this internal colonization, whilst laymen played

[1] Oberbeck, G., 'Die mittelalterliche Kulturlandschaft des Gebietes um Gifhorn,' 1957.

[2] Jäger, H., "Die Entwicklung der Kulturlandschaft im Kreise Hofgeismar," *Göttinger Geog. Abh.*, 8 (1951), and "Entwicklungsperioden agrarer Siedlungsgebiete im mittleren Westdeutschland seit dem frühen 13 Jahrhundert." *Würzburger Geog. Arbeiten.*, 6 (1958).

[3] Higounet, C., "Essai d'une géographie du Comminges au XIIIe et au XIVe siècles," in 'Le Comté de Comminges de ses origines à son annexion à la couronne.' II, 1949, 397–511.

the dominant role in reclaiming land from the sea inlets, along the coast itself, and around the islands of Wulpen and Koezand.

In the fourteenth century decline set in; wars internal and external, social agitation and the rise of Bruges disrupted the urban economy. Settlers were no longer attracted from the interior as the opportunities of the coastlands began to fade. The process of sedimentation was slowing down, and the polders inned along the Zwin and Houte were smaller than their predecessors. By 1335 land was being lost to the sea. The climate worsened, tempests became more frequent, and after a considerable inundation in 1357, a great flood penetrated into those lowlands formerly covered by peat in 1375–6. Several settlements were wrecked—Wevelswale and Ter Piet among others—and, although the towns suffered little, internal disturbance hindered recovery; some lands had to be left outside the new dykes which were built. After a short period of piecemeal loss and gain, the region was struck by the "St. Elisabethsvloed" of 1404. Many lands were re-flooded; two towns (Hugevliet and Yzendyke) disappeared, and Biervliet survived only as an island. The process of early medieval reclamation had contributed itself to this, its downfall. By embanking large areas in the sea inlets and around the islands, the pioneers had obstructed the inlets for advancing storm waves, and only exacerbated the attack when it came; they had taken in, during the calm periods, more land than their small dykes could protect when the storms came.

Although less land was flooded in 1404 than in 1375–6, the later flood had a more disastrous effect. It disheartened the populace and caused a second major loss of capital; at the end of 1404 Westelijk Zeeuws-Vlaanderen was smaller in area than at any time in the previous three centuries, and too impoverished to commence any renewed attack on the sea. Most of the reclamation which occurred in the early fifteenth century was carried out under the impetus of laymen from outside the area, notably Count John. The solid defence works built under his direction reaped their reward in 1421 and 1424, when major storms made no serious breaches in the dykes. Other forces now entered to disturb—English soldiers ravaged Flanders in 1436 and the revolt of Gand in 1452–3 was followed by a revival of pillage. Some of the local inhabitants fled, whilst the poverty of those who remained only increased. Local inactivity continued, and only small areas had been improved when a disastrous flood came in 1477, to be shortly followed by other breachings of the dykes in 1480 and 1483. Finally, the civil war of 1488–92 disrupted farming and wrecked the internal drainage system; the dykes were left unattended and unrepaired, allowing seven parishes to be inundated, of which only two were later recovered. Apart from the early works under Count John and the small-scale activity of the sixties, the fifteenth century saw nothing but decline in the region. While the islands of Wulpen and Koezand shrunk, and the sea-arm of the Zwarte Gat was widening, accumulation of sand in the Zwin threatened the prosperity of Bruges; sedimentation was going on in the one place where it was not wanted.

The parlous conditions in 1492 aroused the authorities and a great dyke was constructed from Terneuzen to Boechoute via Axel and Assenede, abandoning the considerable areas of former farmland which lay beyond it. Taxation for drainage was extended to all Flanders, and with the proceeds several polders, larger than any previously reclaimed, were inclosed from the sea. The inhabitants of Bruges pushed through, amidst considerable opposition, the canal of Oostburg, but it improved the navigation of the Zwin not one whit. The floods came again in 1530 and 1532, and wreaked most havoc in the oldest reclaimed lands, where the defences were weakest and the land surface lowest; this process had appeared in earlier floods also, and by 1532 the old towns—Aardenburg, Biervliet and others—were much declined, whilst newer settlements like Westervliet were expanding. The old lands continued to succumb to the waves—each new breach meant a retreat of the dykes—but the floods of the thirties stung the authorities into heavier taxation, and between 1532 and 1570 the reclaimed area was considerably enlarged. This reclamation was aided by a slow

fall in sea level which continued into the seventeenth century. This change in sea level was contemporaneous with a steady drop in temperature and the sea defences were occasionally troubled by accumulations of ice. A small flood of 1570 did not seriously affect the innings of the previous years, but it was soon followed by disaster, not from physical but strategic causes. In 1582 Parma, the Spanish general, was advancing into the insurgent southern Netherlands and had already captured several towns. To halt his advance, the land around Sluis was inundated and in the following months many other dykes were breached; by the end of 1583 the whole region was submerged. Neither Spain nor the United Provinces could spare time for reclamation, and the first new dykes in this area were not built until the truce of 1609–21. Sea waters cut wide channels and the tides laid a thick bed of silt over the submerged surface of medieval Zeeuws-Vlaanderen. When reclamation began, it created a new landscape of polders on an almost wholly new land surface. Few chapters in historical geography have so clear and irrevocable an ending.

The temptation, perceptible in Oberbeck's study and demonstrable in Wrede's work on field systems,[1] to extrapolate the conditions portrayed in later maps and documents backwards to remedy the absence of medieval data, is easily avoided in Zeeuws-Vlaanderen. The bare narrative of reclamation and inundation is sufficient to render such a tampering with chronology openly inaccurate in this district, and at the end of the sixteenth century the medieval landscape lay buried beneath a cover of sediment. That the lineaments of this pre-diluvian medieval landscape have been revealed is testimony to the skill with which Dr. Gottschalk, after enumerating the errors incepted by sixteenth century and later historians, examines the original sources. Published documents are combined with the resources of the archives of Gand, Bruges and Lille, and all classes of evidence—cartulary, deed, chronicle, inventory, register—are pressed into service. Air photographs reveal former watercourses, sixteenth century maps are used to the full, and the author was so fortunate as to find a unique schematic plan of several polders drawn up in 1358.[2]

If there is any regret after reading this study of Zeeuws-Vlaanderen it is, as with Higounet's research, that more of the medieval data were not expressed cartographically. The difficulties are very great when the base map of land and sea suffers so many changes, but H. C. Darby, 'The Medieval Fenland' (1940), shows what can be done in a comparable area of coastal wetlands although favoured, in this instance, by the exceptionally rich archives of medieval England. The fault, however, is less material than the achievement—a clear outline and much of the detail of the changing landscape of Zeeuws-Vlaanderen from the tenth century to the sixteenth. The sources have not been abused but they have been mastered; their intransigence is not allowed to smother the story in a welter of reservations. This is a study of historical geography *sui generis*, studied not because it throws light on the present landscape (it does not—the lineaments of the present scene were laid on a new cover in the seventeenth century), but for the interest of the changes in themselves. J. L. M. GULLEY

A NOTE ON THE FORMER EXTENT OF LAKE CHAD

In a recent paper on the ancient erg of Hausaland, I mentioned a large sand ridge running from Maigumeri to Bama, and other features appearing on air photographs of the area further north, and suggested that they represent an old shoreline of Chad, formed when the lake stretched 130 kilometres further west than now.[3] Pias and

[1] Wrede, G., "Die Langstreifenflur im Osnabrücker Lande," *Osnabr. Mitt.*, **66** (1954), pp. 1–102. Compare the warning by C. Schott, "keinesfalls können wir aus Flurkarten des 18 und 19 Jhs. das Bild der germanischen Landschaft der Frühgeschichte erschliessen." *Zeit. d. Ges. f. Erdkunde zu Berlin*, 1939, p. 649.

[2] Dr. Gottschalk has devoted a separate study to this map—"De oudste kartografische weergave van een deel van Zeeuwsch-Vlaanderen." *Archief Zeeuwsch Genootschap* (1948), p. 30.

[3] Grove, A. T. (1958) "The ancient erg of Hausaland, and similar formations on the south side of the Sahara." *Geog. J.*, **124**, pp. 528–533.

Guichard had already described a similar ridge, rising about 12 metres above the plains, and running from Limani on the Nigerian frontier to Bongor on the Logoné river.[1] They pointed out that Bongor is in the zone of capture between the Logoné and the Mayo Kebbi, a right bank tributary of the Benue, and that when Chad stood at this old shoreline it overflowed to the Atlantic via the Benue. In April of this year I verified from air photographs at the Institut Géographique National in Paris, that the Bongor–Limani shoreline is a continuation of the Bama–Maigumeri ridge, and that a ridge probably representing a shoreline at about the same height can be traced north of the Komadugu Yobe (Fig. 1).

Figure 1

The level of Lake Chad varies from season to season and its surface slopes from about 283 m at the south to about 280 m at the north end.[2] At Bongor, the height near the Logoné is given on recent maps as 308 m, and that river overflows to the Benue system by Fianga at 309 m in times of flood. At Maiduguri, a section has been levelled across the shoreline, and its height above sea level has been determined by a survey made in connection with the building of a new railway from Kuru to Maiduguri.[3] From Figure 2 it can be seen that the crest of the ridge stands at 334 m and the level at the foot of the ridge on the side towards the lake is 318 m. It is not certain that the heights given for Bongor and Maiduguri are strictly comparable, and the discrepancy between the figures could be due to inaccuracies of one or both of them. However, it is interesting to note that a lake standing at about 310 to 320 m would have extended through 8° of latitude and would have been more than 150 m deep over the

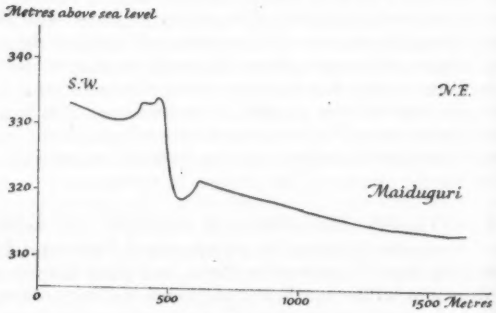


Figure 2

[1] Pias, J. and E. Guichard (1957). "Origines et conséquences de l'existence d'un cordon sableux dans la partie sud-ouest de la cuvette tchadienne." *C. R. Ac. Sc.*, **244**, p. 791.

[2] Bouchardeau, A. (1956). 'Le Lac Tchad.' Annuaire Hydrologique de la France d'Outre-Mer.

[3] This information was kindly given to me by the engineering consultants, Messrs. Rendel, Palmer and Tritton.

centre of the Bodélé depression. This mass of water could have caused some sinking of the lake floor and then, with the shrinkage of the lake to its present size, the shoreline would have been tilted southwards in the southern part of the basin, in the sense indicated by the heights mentioned for Maiduguri and Bongor.

If it is assumed that this greater Chad existed, and evidence has been available for several decades that lakes were once more extensive in the northern parts of the basin than they are now, the climatic implications are of some interest. The evaporation from the present lake is believed to be of the order of 200 cm per annum[1]; the mean precipitation is about 33 cm, and about five-sixths of the water entering the lake and balancing the evaporation losses is brought in by the Logoné–Chari. When the greater Chad stood at the Maiduguri–Bongor shoreline, mean annual temperatures were possibly as much as 5° C lower than now, and the evaporation losses might have been nearer the figure for Lake Victoria at the present time, namely about 160 cm per year.[2] But the area of the greater Chad probably approached half a million square kilometres, some 25 times that of the present lake, and the mean rainfall over the area it occupied is at present less than 33 cm. It follows from this, that the discharge of rivers into the greater lake, to maintain its level at 310 to 320 m, must have been about 20 times greater than at present, assuming that the isohyets have not shifted since that time. Lower evaporation over the catchment of the lake as a result of lower temperatures is unlikely to have allowed river discharges to have been much greater than the present ones, and it is difficult to escape the conclusion that when Chad was so much greater than now, the isohyets must have run at least a few degrees north of their present positions.

A lake at 310 to 320 m would have reached as far north as Borku and might have been sufficiently large to modify the climate of southern Tibesti. Even if the precipitation there was little greater than now, the lake shores would have provided a habitat congenial to animals of the savanna lands and to early man.

In a recent paper, Pias describes two earlier trangressions of Chad greater than this one, and a later minor transgression, with intervening arid periods.[3] If these took place, then presumably evidence for them is to be found in north-east Nigeria. It is hoped to carry out some field-work in that area early in 1960. A. T. GROVE

THE TRESCO VALHALLA, ISLES OF SCILLY

The Council of the Society for Nautical Research is raising a fund of £2000, to be held in trust by the Society, to complete the restoration of the collection of figureheads and other relics of ships wrecked on the Isles of Scilly and preserved in the famous subtropical gardens of Tresco Abbey, and known as the Tresco Valhalla. Some forty shipwrecks are represented. In 1957 a team of skilled repairers were put to work by Lieutenant-Commander T. M. Dorrien Smith, R.N. (ret.), with technical advice from the Ministry of Works and the National Maritime Museum.

The progress of decay has been stopped and the work of restoration has progressed so well that it has been possible this year to reopen to the public this small open air museum. The open-fronted building built by Mr. Augustus Smith some time in the 1850's has been enlarged so that all the exhibits can be housed under cover. But much work remains to be done before the restoration of this delightful and historic collection can be regarded as complete. The Council of the Society for Nautical Research is satisfied that this collection is of national importance and worthy of preservation. The National Maritime Museum is advising on the restoration so as to ensure historic accuracy. Contributions to the Tresco Valhalla Fund should be sent to the Hon. Secretary, Society for Nautical Research, c/o The National Maritime Museum, Greenwich, S.E.10.

[1] See note 2, p. 466.

[2] Walker, H. O. (1956). "Evaporation from Lake Victoria." *Weather*, **11**, p. 384.

[3] Pias, J. (1958). "Transgressions et régressions du Lac Tchad à la fin de l'ère Tertiaire et au Quaternaire." *C. R. Ac. Sc.*, **246**, p. 800.

NORTH OF THE HIMALAYA BY AIR

Those who have occasion to travel to and from India, or those countries beyond, such as Australia and the Far East, will be aware of the Delhi–Moscow air services, and may be interested in my experience of this route, by which I travelled at the end of February 1959 by Soviet Tu.104a jet aircraft. I had expected the aircraft to follow the southern edge of the mountains, via the Punjab and Afghanistan, which is, I believe, the usual way used both by Soviet and Indian air services. But, possibly for some political reason, the aircraft on this occasion took a route over the Himalaya, which was a stroke of exceptional good fortune. By either route the journey is of particular interest to lovers of mountains, for there can be no scheduled route in the world with more spectacular scenery. I had, unfortunately, no map of Central Asia, and it was obviously prudent not to attempt photography from the aircraft, which is strictly prohibited by both Indian and Soviet authorities. However, I travelled on a day of infinite visibility when familiar mountains were easily recognizable and others impossible, for anyone reasonably familiar with mountaineering literature, to mistake. Naturally I studied the maps as soon as I could get to them and pieced together the vivid recollection of what I had seen. I think I am probably not far wrong in concluding that we travelled first N. 15° E. from Delhi to Khotan where, according to the new *Times* Atlas, there is an airfield, so probably a radio beacon. Then we turned N. 54° W. to Kashgar, and thence direct to Taskhent where we came down for refuelling and customs.

The aircraft, so we were told, climbed to 10,000 metres and travelled at 800 km. per hour. The plains of Northern India soon disappeared under a dust haze and the Himalaya rose on the horizon. Then we were over the foothills, with a dusting of snow among the north slope forests and sunny villages above the valleys. Nanda Devi was unmistakable, then the Kedarnath and Badrinath peaks nearer to, and Kamet towering up behind. Far beyond, to the east, was one shadowy group—perhaps Api Nampa in Nepal. Soon from the port windows, straight below us under heavy winter snow, were gentler peaks of Alpine character, probably those of Spiti. One substantial peak which I have not identified dominated this group to the south-west. Far away, north of west, was the long straight trough of the upper Indus valley, and to the right beyond it, a huge mountain group—the Karakoram: to their left was dimly a separate group, conceivably Nanga Parbat over two hundred and fifty miles away.

We were quickly over and above the vague borderland of Ladakh and Tibet, a savage empty country still considerably mountainous, nearly bare of snow and with numerous lakes; some were frozen, some blue in the drab brown landscape. Only very rarely was there a hint of a track or trade route and never a sign of a dwelling. From here Kailas stood alone on the eastern horizon. And further to the north a great spire of a solitary peak rose above the uplands of Central Tibet. This was perhaps Aling Kangri, a mountain which must be formidable to reach, let alone to climb. To our south-west, twin peaks were clear above a rather featureless mass of hills: these were presumably Nun Kun. Below us the mountain uplands, developing into a mountain range, were conspicuous to the east. But I was so preoccupied with the incredible view to the west that I did not recognize the range as the Kun Lun, until after it had suddenly fallen away, and we were over sandy desert. Soon we turned north-west, flying roughly parallel to the main ranges, and came nearer to the Karakoram. These, seen in their entirety from the north, were a prodigious sight. The pyramid of K2 rising from lesser foothills dominated everything, and looked enormous even at one hundred and seventy-five miles distance. To its left were massive satellites, presumably the many peaks of Gasherbrum and the other 8000-metre peaks round the head of the Baltoro Glacier, and I thought I could identify Masherbrum's spire peeping beyond a gap.

Far away to our north a very distant range of peaks came in sight across the desert, obviously the Tien Shan; but these were too far to observe any detail. Cloud, at

perhaps 15,000 feet, now covered the land below. Soon a twin pair of broad peaks came in sight to our west; these were undoubtedly Mustagh Ata and Qungur. Between them and the Karakoram were two separate distant masses which I could not place at the time; perhaps one of them was the Rakaposhi group. Cloud below ceased, and we passed over a large town, almost certainly Kashgar. Now Mustagh Ata seemed very close, and every detail of the probable route of approach to the mountains through the tangle of dry eroded foothills was clear; so was the high gradual route to the summit from the north. Now we turned west, flying high above the motor road from Chinese to Russian Turkestan. Gradually the Pamirs came in sight to the south, with one dominating peak and a huge stretch of mountainous country about it. But now we were losing height, so saw less of this range than I had hoped. We came gradually down to Taskhent, set in a country of black soil, with cotton estates obviously all ploughed collectively by tractor, a smoky industrial town, and some first class skiing mountains not far away to the north-east. From Taskhent to Moscow the flight was without interest as we were above cloud all the way. B. R. GOODFELLOW

SECOND COASTAL GEOGRAPHY CONFERENCE, LOUISIANA STATE UNIVERSITY, APRIL 1959

The first of these conferences was held in Washington in February 1954, when ten papers were presented. The Committee on Geography, Advisory to the Office of Naval Research, of the National Academy of Sciences—National Research Council served as sponsor for the first conference and, in 1957, recommended that a second should be held in Louisiana in 1959. It later decided to invite some Europeans to this conference, and to emphasize close personal contacts in the field.

A limited number of participants were asked to present papers, but all interested persons were welcome to attend. The active participants were afforded two magnificent excursions—the first was a private flight of more than 800 miles at 1200–1000 feet over the Mississippi delta, the second covered about 300 miles by bus, boat and walking (to visit the mud-arcs left by Hurricane Audrey) on the outer edge of the delta south of Pecan Island. The other members had two long excursions, one in the Atchafalaya basin covering more than 300 miles, and the second in south-western Louisiana to see field evidence of early man in relation to the delta.

There were thirteen papers discussed, seven of them by Europeans (two from Holland, one from West Germany, one from Denmark, two from the United Kingdom, one from France). They ranged from coastal classification, through studies of particular coasts, to the relation of archaeology and physiography in coastal research.

Dr. W. R. Thurston, executive secretary of the Division of Earth Sciences of the National Academy of Sciences, and Miss E. M. Pruitt of the Geography Branch of the Office of Naval Research, were responsible for a great deal of organization. The many details of the conference, and the careful planning of the excursions, fell to the lot of Dr. R. J. Russell of the Coastal Studies Institute, Baton Rouge. He and his colleagues, especially Dr. J. P. Morgan and Dr. W. G. McIntire, succeeded in making the conference memorable not only for its useful papers, discussions and contacts, but also for the outstanding excursions.

Copies of the Proceedings and Field Excursion Itineraries will be available in the Library of the Society. J. A. STEERS

DEVELOPMENTS IN SOVIET GEOGRAPHY

Dr. D. J. M. Hooson, of the University of Maryland, contributes to the *Annals* of the Association of American Geographers (**49**, 1 (1959), pp. 73–82) a summary of recent developments in Soviet geography. He begins with a brief statement of the marked increase in Soviet geographical writing, and then examines the trends in geographical theory which this displays.

Physical geography is still the dominant partner in the geographical sciences, but more attention is now being given to economic geography, which includes all

non-physical geography. This change reflects the philosophy of economic determinism, but the outlook is becoming more empirical and less dogmatic, and the regional approach is gaining ground. The segregation of physical and economic geography is more favoured by the physical geographers, partly from their dislike of crude physical determinism, than by the economic geographers. The author suggests that this attitude dates from the period of the Five-Year Plans, when physical geographers were engaged in "primary exploration and specific technical problems" in the company of geologists and other technologists, rather than of fellow geographers. The physical geographers were also outside the arena of political controversy, whereas the economic geographers were not. The present advocates of the "monistic" view of geography, mainly the economic geographers, advocate integrated regional studies and "the two-way impact of society and nature." D. N. Anuchin is quoted to the effect that it is the idea of environment which makes a common system of geographical science, ranging from geomorphology to industrial geography. The extent to which this geographical synthesis has been worked out in a regional context is still limited, though some recent regional monographs are evidence of the change. The physical geographers are still strongly placed, but one of the most influential, Academician Gerasimov, has defined the object of geography as "a general study of the natural conditions, economy and population of diverse regions, countries, and the world as a whole."

The author concludes with a reference to the "almost total neglect of Russian geography in the West." Obstacles to the mutual comprehension of American and Russian geographers are being removed, including, on the American side, "crude environmentalism," while Russian geography has been modified by the introduction of more cultural facets and the recognition of the subject as an investigation of a field of knowledge, rather than an instrument of policy. The main difference is the Russian view that a "monistic" view of geography is unscientific. The author asks whether this view may not conceivably be correct, even though the unity of geography is scarcely questioned in the West. It is necessary, however, that all aspects should be adequately developed. The foundations for an integrated study of the physical environment have been established in the United States, but the author expresses the opinion that in much of Western Europe, including Britain, "strong traditions of geographical unity have to some extent been sapped by the persistence of the dominant position within physical geography held by a geologically-focused geomorphology."

G. R. CRONE

INTERNATIONAL GEOGRAPHICAL CONGRESS

The full programme of the Nineteenth International Geographical Congress, to be held in Stockholm in August 1960, may now be obtained from the Assistant Secretary, the Royal Society, Burlington House, London W.1. A very limited amount of money is available to the British National Committee for Geography to assist towards the expenses of qualified persons wishing to attend this Congress. Preference will be given to applicants of junior status engaged in research in Scandinavian geography. Applications for grants, which are not likely to exceed £25, should be made to the Assistant Secretary at the above address not later than 21 December 1959.

NOTES

The Library has received from the QUERINI STAMPALIA scientific foundation, Venice, a copy of the 'Catalogo del fondo cartografico queriniano;' prepared by the Director, Giuseppe Mayzariol (Venice, Lombroso, 1959, L.2000). The theme of the collection is the cartographical output of Venice from the sixteenth to the nineteenth centuries. The largest section lists and describes 236 items, mainly engraved maps published in Venice, and, as might be expected, dealing largely with Italy or Italian

territories. Smaller sections cover plans, globes, marine charts and atlases. An introduction gives a short account of Venice as a cartographic centre. Among those, not by any means all natives of Venice, whose activities as cartographers, engravers or map publishers are touched upon, are Pietro Coppo, Jacopo Gastaldi, Michele Tramezino, some of whose maps are included in the so-called Lufreri atlases, and at a later period, V. Coronelli. Much of the reputation in this respect which Venice won in the early sixteenth century was due to G. B. Ramusio, the editor of the great collection of "Navigationi e viaggi."

* * *

The Annual Report of the COMMONWEALTH INSTITUTE records the passage through Parliament of the Commonwealth Institute Act by which the old Imperial Institute received its new title, effective from 13 March 1958. Despite the dislocation caused by building work on the present site of the Institute, three new "Courts" have been added to the exhibition galleries—Gibraltar, Malta and Cyprus. Thirteen exhibitions were held during the year, including one of project work on the Commonwealth done by schools in the Peterborough district. Work from Canada, India, Malta, Nigeria, Northern Rhodesia, Pakistan and Sierra Leone was included in the displays of art forming part of the exhibition programme. Two sixth-form conferences were held during 1958, one at the Science Museum, and one on the Trans-Antarctic Expedition at the Royal Geographical Society. The latter, held jointly with the Society, was opened by the Society's President, Lord Nathan.

* * *

The 1957–9 edition of THE ULSTER YEAR BOOK, published at three-yearly intervals by H.M.S.O. Belfast, has been presented to the Library. This volume is the tenth in the series and, to quote the preface, sets out "to present in a convenient form statistical and other information regarding Northern Ireland and its people; their social conditions, health, education and industries; and the administrative activities of Departments concerned with central and local government services." The Northern Ireland Ordnance Survey map of the region on a scale of 1 : 500,000 is bound up in the Year Book, which is amply illustrated with plates, text figures and coloured diagrams. The price is 6*s* 6*d*.

* * *

WORLD POPULATION PRESSURES, recently received in the Library, is a 46-page pamphlet by Harold L. Geisert, Department of Sociology, The George Washington University, D.C. It is published as one of a series of studies in the Population Research Project of George Washington University. Population trends are examined in the world as a whole and separately in Europe, Asia, Africa, North and Latin America, and in Oceania (Australia and New Zealand, and the Pacific Islands), and are related in a clear and (on the whole) impartial commentary to economic and political conditions. Fifteen tables, computed from United Nations publications, are included in this useful survey.

* * *

The closing date for the LEVERHULME RESEARCH AWARDS, 1960, is 31 December 1959, and full particulars may be obtained from the Secretary at St. Bridget's House, Bridewell Place, London, E.C.4.

OBITUARY

LORD CATTO OF CAIRNCATTO

The Rt. Hon. Sir Thomas Sievewright Catto, Bart., P.C., C.B.E., first Baron Catto of Cairncatto, was born on 15 March 1879 at Peterhead, Aberdeenshire, and died on 23 August 1959 after a long and distinguished career in commerce, banking and public work. Lord Catto, elected a Fellow of the Society in 1933, had a wide

knowledge of the world which came not from travelling at leisure, but by working as a merchant and man of business in three continents, and as a banker. He was educated at the old Peterhead Academy and at Heaton School (Rutherford College), Newcastle upon Tyne, leaving school at 16 to take up a post with the Gordon Steam Shipping Company of Newcastle. This was the beginning of a career which took him to Russia and the Middle East, to the United States, to India and to the Far East. He held responsible official positions in both World Wars; during the First, he was British Admiralty representative on the Russian Mission in New York, and in 1918 was appointed chairman of the British and Allied Food Missions in the United States and Canada. In the Second World War he was Financial Adviser to the Chancellor of the Exchequer, a post specially created in 1940, and unpaid.

From 1919 to 1931 Lord Catto was head of the old-established merchant house of Andrew Yule and Co., Calcutta, and he became deeply interested in the problems of India during the time he spent there. He became a director of Morgan, Grenfell and Co. in 1928 and in 1936 was created a baron for his services to India. Appointed a Director of the Bank of England in 1940, he succeeded Montagu Norman as Governor in 1944, and held that post during the difficult transitional period of nationalization.

Lord Catto was Honorary Treasurer of the Society from 1946 to 1953 and was a very constant attender at meetings of the Council and of the Finance Committee. His advice on investments was of the greatest value to the Society at a time when, under Lord Rennell as President, it was re-establishing and extending its position immediately after the War. Despite his many national preoccupations Lord Catto was readily available for consultation by the staff in whom he took a particularly kindly interest, and his opinion on financial, as indeed on all, matters was always expressed clearly, decisively, and with the maximum economy of words.

For these virtues and for his generous donation towards the cost of the Livingstone statue, now outside the Society's Hall, he will for long be remembered.

L. P. KIRWAN

APSLEY CHERRY-GARRARD

The death occurred in London on 19 May 1959 of Apsley Cherry-Garrard, the Polar explorer, who had been a Fellow of the Society since 1914; he was proposed to the Society by Sir Clements Markham. Apsley George Benet Cherry-Garrard was born on 2 January 1886, and was educated at Winchester and Christ Church, Oxford. A chance meeting with Dr. E. A. Wilson led to his being invited to join what proved to be Scott's last Antarctic expedition, which covered the years 1910 to 1913. Cherry-Garrard will, perhaps, be best remembered for his own superb account of the expedition, 'The worst journey in the world,' a polar classic read by millions which has run into many editions. Although somewhat handicapped by his lack of scientific training and by very short sight, his unselfishness, courage and practical sense made him a most popular member of the team. He is remembered by his contemporaries as an ideal sledging companion who shared in all major journeys, while at home at base camp he was valued for his contant willingness to lend a hand in all tasks, including editing the *South Polar Times*. The friendship between Cherry-Garrard, Bowers and Wilson was particularly close, and with these two experienced explorers he made the hazardous and nearly disastrous "winter journey" of 1911 to investigate the eggs of Emperor penguins. Earlier in the same year he had a narrow escape when he, Bowers and Crean went adrift on the sea ice and only returned to safety after a thirty hour struggle. The tragedy of Scott's last expedition, and especially the deaths of his close friends, Wilson and Bowers, made a profound and permanent impression upon Cherry-Garrard, one indeed from which he never fully recovered. This and the illness from which he had continually suffered since the First World War no doubt prevented him from developing those talents, especially for writing, with which he was endowed.

MAJOR DENZIL MORTON STANLEY

The death occurred on 25 April 1959, at the age of 64, of Major Denzil Morton Stanley, adopted son of Sir Henry Morton Stanley; he had lived for many years at Furzehill, Pirbright, Surrey, the house bought by H. M. Stanley in 1900 at the close of his African career. Denzil Morton Stanley was educated at Eton and Sandhurst, and was commissioned in the 14th Hussars at the beginning of the First World War. He saw service in India and in Mesopotamia, and retired from the Army in 1927. From then onwards he was active in local affairs, and was High Sheriff of Surrey in 1946. In 1954 he attended the ceremonies arranged by the Belgian Government at Brussels on the fiftieth anniversary of the death of Henry Morton Stanley, whose work in discovering and, with Leopold II, in laying the foundations of the Congo State earned him such high honour in Belgium.

J. E. TRACY PHILIPPS

Mr. J. E. Tracy Philipps, M.C., M.A., Hon.D.C.L. (Durham), who died on 21 July 1959, had been a Fellow of the Society since 1917. He was educated at Marlborough and Durham University, and then became an Assistant Commissioner in British East Africa. During the First World War he joined the Rifle Brigade and served with the Indian Expeditionary Force in 1914. He was seconded to the King's African Rifles, then attached to the Arab Bureau Force, and served in Cairo, Jerusalem, Syria, and Abyssinia. He travelled widely between the Wars and among other exploits made a journey on foot along the Equator from east to west across Africa.

He was often employed on relief missions concerned with minorities or refugees and published many writings on the subject; also on natural history, linguistics and ethnology. He discovered a new variety of otter and also made interesting observations on the gorilla and African elephant.

Tracy Philipps was a member of the International Commission on African National Parks and in 1955 was elected Secretary-General to the International Union for the Conservation of Nature and Natural Resources with headquarters in Brussels. He was specially interested in the sociological and ethnographic aspects of life in tropical or arid regions of Africa and Asia and devoted his later years to the means whereby countries fast receiving self-government could be made to realize the importance of conserving their wild life and natural resources. He had a very wide knowledge of the Middle East and was active in trying to create a better understanding between different cultures, especially Arab and Christian. He had the rare distinction of being honoured by the University of Teheran, by the Lincei in Rome, by the University of Paris at the Sorbonne, and by his old university, Durham. He took an active interest in the Society and gave an account of the Nature Reserves of the Congo-Nile Divide, with colour films, at an afternoon meeting on 15 October 1956. He was also a Vice-President of the Hakluyt Society.

E. HINDLE

HUGH R. THOMPSON

Canadian geography suffered a grievous loss when Hugh Ralph Thompson died after heart surgery on 6 June 1959 at Toronto. He was a Life Fellow of the Society. A New Zealander by birth, he went to school at Loretto in Scotland. After serving in the British and Indian armies from 1944 to 1947, he went up to Oxford and read geography. Four years' post-graduate work in North America ended with his receiving the Ph.D. degree from McGill in 1954. He then joined the staff of McMaster University, Hamilton, Ontario, where he won an enviable reputation as a scholar and teacher. Until prevented by bad health, he was an ardent Arctic specialist. He was a Carnegie scholar at the Arctic Institute of North America and the geomorphologist on both the 1949 Oxford University expedition to North East Land

and the 1953 Baffin Island expedition. He contributed several articles based on his arctic research to scientific journals, notably to *Arctic* and the *Journal of Glaciology*.

At McMaster he not only created by his own enthusiasm a great interest in physical geography among students, but he won the full respect of his scientific colleagues for the brilliance of his ideas and the quality of his research. He was therefore able to cooperate effectively and in the field with geologists, biologists, botanists, geophysicists and others. In this way he did much to enhance the status of geography in Canada. Although a physical geographer and geomorphologist by specialization, he never lost sight of the importance of regional geography and insisted upon the necessity of a final synthesis of the various branches of the subject. This he put into practice in his own writing and in his lectures. He served with outstanding success as Chairman of the Southern Ontario Division of the Canadian Association of Geographers in 1956. Hugh Thompson is mourned as a man of the utmost integrity and as a faithful friend. Our grief is the greater for his youth—he was only 32.

W. H. PARKER

WILLIAM PATRICK GORDON THOMSON

The premature death of W. P. G. Thomson at the relatively early age of 44 leaves a gap both in the Fellowship of the Society, to which he was admitted in 1958, and on the staff of the Permanent Committee on Geographical Names which is housed at the Society. He was born on 28 September 1915 and educated at Trinity College, Glenalmond, and Balliol College, Oxford, where he took Honour Moderations Class II and Literae Humaniores Class II. He also held the Diploma in Anthropology with distinction in Social Anthropology. Besides such academic qualifications, he was a fine rifle shot, having represented Oxford, 1936–38, and having shot for Scotland on a number of occasions, the last being in the Scottish Elcho team in 1958. He also shot for the Sudan.

Thomson, an accomplished Arabist, joined the staff of the Permanent Committee on Geographical Names in 1956, and had before that served all his adult life in the Sudan Political Service. He had a great love for Sudan and the Sudanese, like so many members of his service, and a wide knowledge and understanding of its history and current problems. He applied his anthropological interest particularly to the Shilluk people living round Kodok, and contributed to *Sudan Notes and Records*.

Thomson's concern for Sudan formed part of his wider interest in the Middle East, both language and culture, which is so evident in the reviews he wrote for the *Journal*. He was a man of acute intelligence and wide and liberal views, and combined with these intellectual attributes a kindly, modest and charming personality. In this building and among his many friends from Sudan and elsewhere he will be greatly missed.

L. P. KIRWAN

CHARLES LASERON

The death occurred in Sydney on 27 June 1959 of Charles Laseron, who was assistant biologist on the Australasian Antarctic Expedition, 1911–14, led by Sir Douglas Mawson. He took part in the journey to the Magnetic Pole and later in geological surveys along the coast; 'South with Mawson,' first published in 1947 and reprinted several times since, was his own account of the expedition. Charles Laseron was born in Mantowic, U.S.A., in or about the year 1886, the son of an Anglican parson, came to Australia as a child and was educated at Lithgow, New South Wales. He fought at Gallipoli in the First, and was a map instructor in the Second World War. His two geological books, 'The face of Australia' (1953) and 'Ancient Australia' (1955), describe in particularly clear terms the geology and topography of the continent.

CORRESPONDENCE

ANCIENT CULTIVATION IN THE NEGEV

In the *Journal* for June 1957 Yehuda Kedar described "Some ancient agricultural achievements in the central Negev." Recent work by some of his compatriots seems to contradict one of his theories. In outlining his explanation of the *tuleilat el 'anab* ("vine mounds") Kedar writes (*Geogr. J.*, **123** (1957), p. 185): "They were created when man decided to speed up the processes of natural erosion. In order that the slopes should supply him with run-off water and soil, he opened the desert pavement and broke the crust that covers the softened soil underneath." According to other workers, however, various facts are in opposition to this view. A recent series of three articles has appeared in Israel periodicals under the general title of "The ancient desert agriculture of the Negev," the first two in *Ktavim*, a journal edited by the Rehovoth Agricultural Research Station, and the third in the *Israel Exploration Journal*. Titles and authors are: I. "Gravel mounds and gravel strips near Shivta (Sbeita)," by N. H. Tadmor, M. Evenari, L. Shanan and D. Hillel, *Ktavim*, **8**, 1–2 (1957), pp. 127–51; II. "Utilization of runoff from small watersheds in the Abde (Ovdat) region," by L. Shanan, N. H. Tadmor and M. Evenari, *Ktavim*, **9**, 1–2 (1958), pp. 107–29; III. "Early beginnings," by M. Evenari, Y. Aharoni, L. Shanan and N. H. Tadmor, *Israel Exploration Journal*, **8**, 4 (1958), pp. 231–68, Plates 41–52.

Points made in these articles, and also communicated to me personally, may be summarized as follows:

(*a*) The gravel mounds sometimes occur on watersheds draining into cisterns; silting is not welcome in cisterns.

(*b*) The gradient of the collecting ditches (0·5 per cent.) seems too low to favour the carrying of silt.

(*c*) Little erosion has, in fact, taken place.

(*d*) The arrangement of the gravel strips is often *oblique* to the contours on slopes above 4–10 per cent., so as to lessen the gradient.

(*e*) There is plenty of soil, unused and unterraced, in the Shivta valley, the area studied in detail by the above workers.

The stones were cleared, then, to increase run-off over the "loessial crust" which, as Hillel has shown (Ph.D. thesis, Hebrew University, Jerusalem, 1957), would develop on the bare surface after the removal of the stones of the desert pavement; perhaps in a few isolated cases the crust was broken to induce erosion into a terrace which lacked soil, but only exceptionally.

The studies I have mentioned have received considerable publicity in the press recently, but seem to be little known in geographical circles. Copies of the articles cited have been lodged in the Library of the Society.

C. VITA-FINZI

Department of Geography,
Cambridge
24 *June* 1959

SOIL SCIENCE

"Is there such a subject as soil science, or is there merely—as one reviewer of a text-book called it as late as 1952—a 'hot-potch of sciences' applied to the study of soils?" These words form the opening of Dr. W. T. H. Williamson's Presidential Address delivered on 7 September 1958 to the British Society of Soil Science, and printed in the *Journal Soil Sci.*, **10** (1959), pp. 1–4. The familiar note which they sound to the geographer, accustomed to discussions of the nature of his own science, is repeated in subsequent parts of the Address. Dr. Williamson begins by calling attention to the lack of recognition by the general public of the study of the soil as a science in its own right. This he relates to the valuable but one-sided approach pioneered by Liebig,

whose report to the British Association entitled "Chemistry in its application to agriculture and physiology" was published in 1840. Practical applications of the knowledge obtained through this approach have been of immense value to mankind in increasing crop yields; but it has tended to restrict the study of soils in such a way as geology might have been restricted if it had remained tied to mining (from which it took its origin, in its modern form, through the work of Werner and his school). Soil science has to overcome the difficulty, like that of geography in Britain thirty years ago, that its workers are mainly recruited from graduates in "one or other of the so-called pure sciences . . . pitch-forked into soil work in a research institute," and Dr. Williamson pleads for greater preliminary training in the subject itself. "Bacteriologists may isolate organisms from a soil and find that in pure culture they produce this or that substance. Does it necessarily follow that the same reaction will take place when the medium is the soil itself, and there are possibilities of interactions with other organisms?" As an example of the need for a firm body of discipline he cites the present lack of precision in terminology, as for example in the meanings which have been given to "podzol" and "catena."

He then describes what he regards as the essential core of the science. It should rest on accurate recording of the morphological features of the soil in its natural state; the individuality of every soil must be recognized; and it should be studied in relation to its origin and environment. Application of the techniques of other natural sciences is very necessary, but these should be directed towards the end of explaining soil features recorded in the field, and not of isolating some problem primarily of interest to these sciences themselves. If the liberty is taken of substituting the word "landscape" for "soil" in this description, and of including the social sciences with the natural, a concise definition is obtained of the basis of geography as a science.

ANTHONY YOUNG

P.O. Box 87,
Zomba,
Nyasaland
9 *June* 1959

VALLEY ON THE MARCH

In his review of my book 'Valley on the March' your reviewer (*Geogr. J.*, 125 (1959), pp. 246–47) states that a footnote in my book at p. 84 refers the reader to the wrong folding plan (map). This is not however the case, though I can see why he thought so. The folding plan in question is one of two, both compiled from Ordnance Survey sheets though only the second map gives the references and acknowledgement. The first plan was in fact also compiled from O.S. sheets but from an old block copper-plate edition (now out of copyright wherefor no acknowledgement was needed). This edition, with a few additional names, was used because of the greater clarity of the parish boundaries and names. It might have been better had I given page references to both maps in the peccant footnote.

But the main reason for this letter is to air, as I hope, the difficulty I have experienced in reproducing modern O.S. 1″ and smaller scale maps in books and periodicals, on account of the immense amount of detail they contain even when the plain black sheets are used. It is not satisfactory to enlarge the 1″ in reproduction, and very laborious and rather expensive at that: to reduce the 6″ edition has the same disadvantages. The newer 2½″ is a bit of a hybrid and does not seem to me to reproduce very well. The only way out is to have a map drawn for the purpose required, perhaps based on the Ordnance Survey material: but that is very costly indeed.

I am sorry to say that several other misprints occur in the text (all of them printer's errors!) which have escaped your reviewer's eagle eye. But I admit to being surprised to hear that there are libraries who would not know the works of Margary, Stenton and Nash-Williams, even without their initials, when the date and name of the publishers of the works quoted are given.

RENNELL OF RODD

15 *September* 1959

MEETINGS: SESSION 1958–59

Meeting of 27 April 1959. Professor W. G. East in the Chair

Paper: History in a map. By E. M. Yates

Meeting of 11 May 1959. The President in the Chair

Elections to Fellowship: R. J. F. Andersson; Rev. B. L. Armstrong; Miss S. Basu; H. D. Dukhan; Charles E. Hartley; James B. Knight; Richard M. O'Donovan; A. R. Jabez-Smith; Norman H. Stansfield

Elections to Associate Membership: J. W. E. H. Gittins

Paper: Explorations in Patagonia. By Eric Shipton, C.B.E.

Meeting of 25 May 1959. Mr. Leonard Brooks in the Chair

Film: Unearthing Roman Verulamium. Commentary by Sheppard S. Frere

Meeting of 8 June 1959. The President in the Chair

Elections to Fellowship: Louis Baume; James R. Baxter; John T. Calvert; Ian Chippendale; James R. Cochrane; Rowell E. Debysingh; E. J. P. Devereux; J. P. E. Dias; Cyril G. Dines; Flying Officer John Dixon; Alan J. Dumayne; Captain Peter F. C. Elphick; The Hon. David C. Geddes; Robert W. Germaney; Kheenarain Gokulsing; Reginald T. Gray; James Pope-Hennessy; Hugh Humble; A. Kay; James D. Lovelock; A. Mc. E. Lawson; J. E. T. Loveday; Gordon Mawson; Gordon H. May; Mrs. E. W. Meany; Robert A. Nash; Mrs. L. M. Osman; B. J. Parker; Richard Payne; Alec S. Peacock; James E. Ridout; Mrs. Roger M. Rigby; Roger M. Rigby; Michael I. Ross; J. M. Rothera; John H. Shaw; R. Cunliffe Shaw; George R. G. Shipp; John L. Smart; L. Seymour Smith; Stanley A. Steinman; Harry Svensson; C. W. Pobee-Thompson; Yousef T. Toni; E. A. M. N. von North; Miss Barbara V. Walters; Major G. E. Watson; Peter J. Wheen; Frederick E. Wooden

Elections to Associate Membership: Jack Davis; Bruce A. Gillham; Michael Sill; Miss M. C. Bishop-Stone

Paper: The ascent of Rakaposhi. By Captain M. E. B. Banks and Captain J. Mills

Meeting of 13 July 1959. The President in the Chair

Elections to Fellowship: Mrs. Rhoda A. Abel; Herbert A. Balkham; Lieutenant Commander M. K. Burley; E. C. Chapman; Paul E. du Toit; C. M. Evans; Roy A. Gallant, B.A.; George Greening; Flight Lieutenant C. M. Hanson; Geoffrey B. Hobbs, F.R.I.B.A.; John P. L. Kemp; Sir Gilbert Laithwaite, G.C.M.G., K.C.B., K.C.I.E.; F. L. Lee; Miss Y. Paterson; Rev. John Peckham; A. W. Pettley; Captain A. Salomon; A. C. Shearman; R. G. Hollies-Smith; G. H. Stevens; Richard Thomas; David H. Turnbull; Miss G. Vasey; Dr. Warren Walker; G. D. V. Walker; W. L. Wilson

Elections to Associate Membership: Peter Butler; Roger J. Hoskin; Peter R. V. Marsden

ANNUAL GENERAL MEETING, 15 June 1959. The President, the Rt. Hon. LORD NATHAN in the Chair.

The HON. SECRETARY, Dr. Edward Hindle, F.R.S., read the Minutes of the Annual General Meeting held on 16 June 1958; these were confirmed, and signed by the President.

The President then delivered his Presidential Address which is printed at pages 293–8.

The PRESIDENT: Whilst I have been making what is sometimes called the "Anniversary Address" Mr. Tunstall, who is sitting just inside the door, has arrived from New York with a record of the *Nautilus*, which the American Geographical Society

asked him to deliver to us today. How apt this is in time and presentation! Thank you very much. Now, Ladies and Gentlemen, we will proceed to the presentation of Medals and Awards. Two of our Medals, the *Patron's* and the *Founder's*, are given on the recommendation of the Council, subject to the approval of our Patron the Queen. Therefore those who receive these Medals have a double recognition, first by the Council of the Royal Geographical Society, and then by our Sovereign. The *Patron's Medal* this year goes to Commander Anderson of the United States Navy for having achieved the first trans-Arctic submarine voyage by way of the Pole, in the United States Submarine *Nautilus*. Some of you may remember that three years after the late Sir Hubert Wilkins was awarded his Patron's Medal in 1928 he secured the loan of the United States Naval Submarine 012 which he named the *Nautilus*. That summer Wilkins left Spitsbergen in this vessel and, although he ran into severe weather and suffered heavy damage to his submarine, he reached upwards of 82° North before returning. This gallant but unsuccessful pioneer attempt by our Australian Medallist has been crowned twenty-seven years later by Commander Anderson's great achievement. By this trans-Arctic voyage Commander Anderson and his men have not only been the first to complete a northern passage by submarine, they have opened up a new vista in Arctic travel, leading to the regular passage, we may hope, of freight-carrying submarines between Europe and America by the shortest route.

Commander W. R. ANDERSON: Modern exploration is seldom possible without the work of those who have gone before, without the knowledge gained by those who have preceded us; but perhaps most important of all modern exploration must rely strongly on the traditions established by those who have first moved into the new environment. The cruise of the *Nautilus* followed and was vitally benefited by long years of polar exploration. It followed countless expeditions, many of which carried the British flag and were sponsored by the Royal Geographical Society. Modern exploration does not succeed without teamwork. Ours was a voyage made possible by the miracle of nuclear power, by those who first saw its impact on ship propulsion, and by one hundred and sixteen men and officers and scientists who worked as a team to achieve a new goal. I accept this wonderful award from the Royal Geographical Society as sponsored and approved by Her Majesty in all humility and I should like to think that I am accepting it as a mark of the continuing polar exploration, as a mark of the traditions that have come from past polar explorations, and as a mark of the extreme teamwork which went into the voyage of the *Nautilus*. Thank you very much.

The PRESIDENT: The *Founder's Medal* goes to our Vice-President, Sir Raymond Priestley, who has just returned from a voyage of exploration. Sir Raymond Priestley has the distinction of having served both with Shackleton and with Scott. Throughout his varied life he has kept in close contact with polar exploration and polar science and has contributed greatly to both. More recently, he accompanied His Royal Highness Prince Philip the Duke of Edinburgh on a voyage round the Falkland Islands Dependencies, whose former Governor, Sir Miles Clifford, is amongst our company here. Last winter at a mature age he sailed with the United States Operation Deep Freeze Expedition to the Antarctic and from this he has now happily returned. It gives me very great pleasure indeed to present Sir Raymond Priestley with the Founder's Medal.

SIR RAYMOND PRIESTLEY: When I first heard of this award I had a thing happen to me which a good many of my friends would not believe. I was struck dumb. Fortunately it happened right down in the Ross Sea. I was taking my usual walk on the flight deck and over the loud-speaker the Commander of the ice-breaker *Staten Island* instructed all officers and civilian personnel to go at once to the Ward Room. I dutifully headed in that direction. But he followed up by saying that he had an announcement to make which had to do with one of our younger members, which made me prick up my ears at once. This was the announcement of Lord Nathan's cable about the Award. So that I have had time to get a little used to it. I think I can

do no more than follow Commander Anderson's example by saying how much I owe to my forebears in polar exploration. I had the great good fortune fifty years ago to serve with Shackleton and then soon after with Scott. I knew intimately Edward Wilson and Edgeworth David and Douglas Mawson, and I owe everything to them, and naturally my thoughts turn to them when thanking you, Sir, for this Award.

The PRESIDENT: The remaining Medals and Awards are within the gift of the Council of the Royal Geographical Society. I now come to the Victoria Medal, which goes this year to Mr. Gerald Seligman for his distinguished contributions to glaciological research. The science of glaciology has reached remarkable heights in this country, and the work of British glaciologists has gained a high reputation abroad. This has been due in no small measure to Mr. Seligman's lifetime of devotion to glaciological studies, in the course of which he has not only founded the British Glaciological Society, but is President of it and also editor of the *Journal of Glaciology*.

Mr. SELIGMAN: I am deeply grateful to you for the honour which you, Sir, and the Council, have conferred upon me even though my work has been so definitely self-rewarding; more so, I think, than in many cases. My researches developed straight out of my play. In my youth I was a mountaineer and a ski-mountaineer, and I wanted to know more about the glaciers and the snow which were my delight. At that time glaciological research, which had been active earlier in this century (as Sir Raymond Priestley will well know), was flagging quite badly, especially in this country. By making the task of my later life an attempt to revive it over here, and to add to my own knowledge, I was often able to work in the most glorious conditions imaginable. Picture to yourself, Sir, the mountain landscape, pure white in its mantle of snow. That was my laboratory, its roof a cloudless deep blue sky, its walls the high mountains, the sun-heated air dead calm. Can anyone think of a more perfect condition in which to work, if work it could be called. And when these conditions did not obtain I was still usually in the middle of the ice-covered mountains which had been my inspiration since my early childhood. If I have been able to stimulate others to follow me, and if they in turn have subsequently helped and encouraged me (which they have done to the full), this has only been an added happiness to me. All these things make me say that my task has brought its own reward, and that abundantly. Nevertheless, that reward has been made all the sweeter by the recognition of any services I may have rendered to the science of glaciology—recognition embodied in this valuable and beautiful medal, for which I thank you, My Lord President, and the Council of the Royal Geographical Society with all sincerity.

The PRESIDENT: The next Award I have to announce is that of the *Murchison Grant*, and the recipient has come all the way from India to receive it: he is Professor Chatterjee, the first geographer of Indian nationality since India's independence to receive a major award from the Society. Professor Chatterjee is Head of the Department of Geography in Calcutta University, and has been the Director, and the principal inspiration, of the National Atlas of India Organization. The great merits of the first National Atlas of India have already been extolled in our *Geographical Journal*, and it is a special pleasure to present to Professor Chatterjee on your behalf the *Murchison Grant* for the inspiring and distinguished part he has played in this most remarkable cartographic enterprise.

Professor S. P. CHATTERJEE: Mr. President, Ladies and Gentlemen, it is a pleasure to be present at an Annual General Meeting of the Royal Geographical Society, and it is greater when one receives an award which is associated with the name of one of the most distinguished Presidents of this Society. I thank most sincerely the Council of the Royal Geographical Society for the honour given to me and to the organizations I represent. I must confess that I never expected that the leading geographical society in the Commonwealth would be the first to recognize our work which, after all, is preliminary to what we are aiming at finally. But this early recognition has definitely strengthened my hands and given inspiration to me and my co-workers to

produce something better, something on a much larger scale. We in India are fortunate in having a Prime Minister who takes a personal interest in scientific pursuits of all kinds, and it is no wonder when the scheme of National Atlas was placed before him that he readily accepted it and set the ball rolling. I also wish to take the opportunity of thanking Professor Dudley Stamp for furthering the cause of geography in India and for helping me in many ways. I thank you very much.

The PRESIDENT: Then I come to the *Back Grant*. This year it goes to Mr. David Stratton, whose outstanding services as deputy leader of the Commonwealth Trans-Antarctic Expedition are probably well known to you all, certainly to me. He was responsible for a very considerable part indeed of the administration of the expedition, besides being a member of Sir Vivian Fuchs's crossing party.

Mr. DAVID STRATTON: My service with the Trans-Antarctic Expedition lasted for three years, from the early part of 1955 until 31 December 1958. Obviously during those three years there were a number of memorable occasions—I am happy to say the greater proportion of them occasions memorable for light relief although there were sometimes grimmer aspects. But today there is another occasion to add to them, an occasion which I shall remember for many years to come. You, Sir, and your Council, have granted me the Back Award, or perhaps I should say have awarded to me the Back Grant, and I shall remember that with great feeling for years to come. So may I say quite simply and very sincerely, thank you very much indeed.

The PRESIDENT: The *Cuthbert Peek Grant* also goes to a member of the Commonwealth Trans-Antarctic Expedition, and one, Mr. George Lowe, who has also distinguished himself in Himalayan exploration and who was a member of Sir John Hunt's Everest Expedition of 1953. On both these expeditions Mr. George Lowe was also in part or wholly responsible for filming and photography and he has thereby enabled those British achievements in exploration to be perpetuated for all time.

Mr. GEORGE LOWE: I can merely add to this thanks, respectful thanks. I did look into the records of the Society to read of Cuthbert Peek; he made some recommendations, or stipulations, for people who should receive this award. One was to be able to navigate and be able to find your way by the stars; another was to make observations and useful returns in economic botany. I feel somehow that perhaps I should not be here! To the Society, and you, Sir, thank you very much.

The PRESIDENT: The *Mrs. Patrick Ness Award* is divided between Mr. J. H. Miller who was deputy leader of the New Zealand Party of the Trans-Antarctic Expedition, and Dr. George Marsh, attached to the New Zealand contingent on that expedition. In addition Dr. George Marsh has made a substantial contribution to the activities of the Falkland Islands Dependencies Survey. Mr. Miller and Dr. Marsh have not only jointly achieved a remarkable record in dog-sledging in the Antarctic, but have played a major part in exploration and scientific work. Mr. Miller unfortunately cannot be present this afternoon, and I would ask Mr. Campbell of the New Zealand High Commissioner's Office if he will accept the award in the case of Mr. Miller, and I will then call upon Dr. Marsh.

Mr. R. M. CAMPBELL: My Lord President, Ladies and Gentlemen. As New Zealand's representative I shall be extremely brief. The Acting High Commissioner has asked you to accept the apologies of Mr. Miller, but after all New Zealand is a long way away, even for a traveller, and Mr. Miller is unable to accept this award in person. Nevertheless, Sir, he has asked me to convey to the Council his deep appreciation of this award.

Dr. G. MARSH: I would like to thank the President and Council for the honour they have done to me by this award, and I would also like to say that when I first heard of it I was not only honoured; I was surprised and delighted. I was surprised because I never thought of anything like this happening, and I was also surprised because one does not expect an award, or I did not, after spending two very enjoyable expeditions in the Antarctic. I was also delighted because (and I am sure that Mr. Miller would agree with me), on both my journeys to the Antarctic any work that I may have done

has been done with rather an old fashioned means of transport which in this modern age many people may think is out-dated—and I speak of the humble dog-team. So I think perhaps it may be a compliment to them as well as to Mr. Miller and myself. Thank you very much, Sir.

The PRESIDENT: I have left the award of the Gill Memorial to the last because it goes to one of our own company and gives me special pleasure to present. And I am sure it will give equal pleasure to all members of the Society familiar with the devoted and talented work of Mr. G. S. Holland in the field of cartography. Mr. Holland has been in the service of the Society since 1926 and of recent years has been our Chief Draughtsman. The *Gill Memorial* this year is awarded to him for his many valuable contributions to cartographical research and cartographical drawing, and in particular for his recent contribution to the cartography of Southern Arabia.

Mr. G. S. HOLLAND: For more than twenty years I have been writing certificates of awards, and now I find I have had to write one for myself. There have been five each year for some time now, and sometimes six, so that by now I perhaps have reached my century, and for that my skipper presents me with my county cap, and a benefit. It has been greatly to my pleasure, satisfaction and encouragement to find that my work, purely routine and without the excitement or glamour that perhaps attends some of the work of the recipients of awards, is recognized in this way by the Council. I owe a very great deal to earlier colleagues in the Drawing Office, particularly Mr. Harry Milne and Mr. Charles Denny for the fine example they set with their high standard of work. I owe also a great deal to the present members for their capable assistance and loyal support. The award has been made partly for a map of Southern Arabia, and as always it is the joint effort of a number of individuals and bodies. We had the greatest possible assistance from the principal author of the surveys included, Professor Hermann von Wissmann, in the form in which he presented his material, thereby saving us a great deal of labour. The President has already mentioned Dr. Serjeant who made a valuable contribution. We received valuable assistance from the Director of Overseas Survey and for the pleasing appearance of the final map we are indebted to the Survey Production Centre of Military Survey. I thank you, Sir, indeed for the honour you do me today.

The PRESIDENT then drew attention to the Annual Report which had been previously circulated, and called the Hon. Treasurer, Mr. Leonard Brooks, to speak about the Balance Sheet and Accounts.

At the conclusion of Mr. Brooks's speech the Annual Report and Balance Sheet were adopted. Commander R. Harrison and Captain J. M. Legg acted as scrutineers of the Ballot for elections to the Council, and it was announced at the close of the meeting that candidates proposed for the Council and as Officers for the ensuing year had been elected.

THE ANNUAL DINNER

The Annual Dinner of the Society was held at the Dorchester Hotel, Park Lane, on 15 June 1959. Lord Nathan (President of the Society) and Lady Nathan received the company of 310. The United States Ambassador, the Hon. John Hay Whitney, was the principal guest and proposed the Toast of the Society. Other guests were Mrs. Whitney, Commander W. R. N. Anderson, U.S.N. (Gold Medallist), and Mrs. Anderson, General Sir Francis Festing, Chief of the Imperial General Staff and Lady Festing, and Sir Maurice Bowra.

After Grace by the Reverend Gregory Hopper, the President read the telegrams exchanged between the Society and Her Majesty The Queen:—

"As President Royal Geographical Society and on behalf of Council Fellows and Members assembled today for Anniversary Meeting presentation Royal Medals and Annual Dinner I beg leave to offer to Your Majesty our Patron loyal greetings and respectful affection."

Her Majesty replied as follows:—

"Please convey to the Council Fellows and Members of the Royal Geographical Society dining together this evening my sincere thanks for their loyal greetings and their kind message which as Patron of the Society I greatly appreciate. ELIZABETH R."

After dinner the Loyal Toasts were proposed by the President and duly honoured.

His Excellency, the Hon. JOHN HAY WHITNEY: My Lord President, My Lords, Ladies and Gentlemen.

It is an honour for my wife and myself to be in this distinguished company tonight, and I see it as a great privilege for me, a non-explorer, a non-discoverer—no oceans, no continents, in fact I cannot even claim the privilege of having climbed the highest mountain in the forty-eight states named, if I may modestly remind you, Mount Whitney. I cannot even claim for it that it is a near relation, and lest it be on record that this is the highest mountain in the U.S.A., I should add that since the advent of our forty-ninth state Mount McKinley in Alaska has made it unnecessary for me to attempt this challenge which I might otherwise have been forced to accept. Now, therefore, let me repeat that it is a privilege for me to be entrusted with the toast which in a very few moments I will propose. It has been written that the science of geography is different from biography: "geography is about maps, biography is about chaps," of course. But even so for all the diversities of maps and chaps there remains a significant, even an obvious relationship. That is to say, if geography is the biography of maps, then biography is in the same sense the geography of chaps; of the valiant and imaginative men who manage, whether they like it or not, to put themselves on the map with as much meaning, with as much prominence, as any mountain or any sea, and, on the side of geography I want to express for myself, and indeed for my countrymen, an appreciation of the great role so long played by the Royal Geographical Society, which has achieved this year the ripe but wonderfully agile age of 129 summers. The history of the Society for much of this long period is the history of British exploration. Africa was the first main field of interest and financial support, but as an American I like to recall that exactly one hundred years ago, in 1859, the Society sponsored an expedition to explore the Rocky Mountains thus helping to open up vast new areas and new frontiers in America. While most explorers in those days were grubbing for gold in "them thar hills," these pioneers were forging the first of the links with America which continue so strongly to this day. There has been, for example, the enduring, and I am sure fruitful, relationship with the American Geographical Society in New York. Today some 330 Americans have the distinction to be Fellows of your Society, a very great honour indeed. And the presentation this afternoon of the Royal Patron's Medal to Commander Anderson is a signal honour in which all his fellow countrymen take pride and feel a measure of sharing. We find it warmly and deeply significant that this presentation should originate in this island home of such legendary polar explorers as Scott, Shackleton, Sir Hubert Wilkins and today, and with what great honour we find him here tonight, Sir Vivian Fuchs. We share in a common heritage of scientific conquest, the peaceful conquest of science over darkness and the unknown. We see in this Royal Patron's Medal one more symbol of the kindred interests of the goals and the determinations that bind the United Kingdom and the United States into the greatest international partnership that history has ever known. To turn for a moment specifically, My Lord President, to one "chap." A man of formidable industry who, I have it on best authority, likes work so well that he scarcely sleeps at all. Lawyer, traveller, lecturer, former Minister of Civil Aviation, former Parliamentary Under-Secretary of State for War, Vice-President of the Army Council, and last, but I would myself say not least, holder of the key of the City of Washington, D.C. His interests are as wide as the world: archaeology, charitable trusts, youth activities, medical research, geographical research and so much more. And therefore, My Lord President and Ladies and Gentlemen, I have great pleasure now in

proposing the toast: The Royal Geographical Society, coupled with the name of the President, Lord Nathan.

The PRESIDENT: Your Excellency, My Lords, Ladies and Gentlemen.

I have listened with eager acceptance to the kind and friendly words spoken by the American Ambassador. As President of the Royal Geographical Society and on behalf of our seven thousand Fellows, the largest number that we have ever attained in all our long history, I thank him for his kindly references to our work. I thank him also for the always welcome but somewhat unexpected tribute to myself. I do not quite know in what capacity I should answer him but I think that I will choose one. For not many months ago when I was a visitor to his great country, I had the distinguished honour which I prize of having conferred upon me the Honorary Citizenship of Washington, D.C. So it is almost as a fellow citizen that I can thank him. But I will tell him more. I was presented with a golden key, a golden key of unwarranted size designed to open the gates, the mythical gates, of Washington to me at will. But if there are no gates for that key to open, I hope at least on the next occasion that I visit Washington it may be found to open some doors for me, and when that may be I do not know but, Mr. Ambassador, there is no hint like a broad hint. Ladies and Gentlemen, when last year I spoke from this place I had just been elected for the first time as President of this historic Society. In accordance with the ancient custom of the Society I was only to assume office at the conclusion of the evening's banquet. At the banquet the task fell to me, the happy and agreeable task, of making a friendly valedictory address to my friend and predecessor General Sir James Marshall-Cornwall here by my side. I wish today to express my appreciation of all the kindness and guidance that during the past year I have received from him as well as from our distinguished Director and Secretary, Mr. Larry Kirwan. Today, Ladies and Gentlemen, I stand here as President in my own right having been re-elected for a further term of office at the Annual General Meeting this afternoon at the end of a twenty-five minutes annual address. That anyone should be so elected after speaking for twenty-five minutes is, I think, a very considerable tribute. And today, this evening, I wear for the first time the badge of the President of this Society designed by one of our guests here Mr. Darcy Braddell, with the crest of the Society at its centre, surrounded by blue to indicate that this is a Royal Society, and that in turn surrounded by the waves of the sea and the stars of the heavens. This is a gift to the Society which I hope may be worn by my successors until the memory of man runneth not to the contrary.

Ladies and Gentlemen, I hold the view that every President of a Society such as this should have a theme for his term of office. My three predecessors of the last ten years, successively, Lord Rennell, Sir James Wordie and Sir James Marshall-Cornwall, had themes ready made for them in a sense: Everest, Antarctica, the International Geophysical Year. I have to think out a theme for myself, and I thought that this evening in a few moments I might perhaps tell you how in that direction my mind works. For exploration now is undoubtedly in process of change. The great and dramatic expeditions, to conquer the Poles, to climb Mount Everest, to cross the Antarctic continent—with all these the Royal Geographical Society was closely linked. But the days of such great expeditions are, I believe, almost over. We have to think afresh. In future exploration may be less sensational. It is likely to be more concentrated in scope and in the intensity of its scientific work. But there is still room, indeed, there is the necessity, for large expeditions in the vast unexplored expanses of Antarctica where equipment must be elaborate and costs so high that only governments could undertake such expeditions. But elsewhere exploration will increasingly be the function of the smaller expeditions which now turn in increasing numbers each year to this Society for support. You will be interested to know—I find it very moving—that the majority of these new smaller expeditions come from the universities, some now from the Medical Schools. This year we had a record number of applications—forty-three. And to show our high standard of approach, only

twenty-one were approved. But forty-three was double the number of three years ago. This is a very welcome development. It imposes new tasks and new obligations on the Society which, as you Mr. Ambassador have said, has for 130 years been the chief centre of British exploration. The Society has, in my judgement, the national duty of ensuring that these are *bona fide* expeditions, a credit to this country and to the Commonwealth, and capable of carrying out some valuable scientific work. But, Ladies and Gentlemen, vital as scientific progress has become in the modern world of today, encouragement of science is not the only, is not, indeed, in my view even the most important reason for supporting these youthful expeditions. The new, and heavy, and fashionable emphasis on science brings with it its own dangers. There is a risk that the term "science" may become abused, that it may become a clichê, that over-emphasis on science may obscure other very significant aspects of exploration. Of these the human aspect is the most important. Partly because of the social and psychological upheaval following two world wars, there is too much talk nowadays, I think, of pensions, of security, too much concentration on personal insurance against the risks inevitable in the battle of life. All this would spell signs of approaching decadence which would involve the denial of the great spirit of the Elizabethan age (which is our proper heritage) were it not countered by the zest for adventure, by the urge to accept and conquer the challenge of the unknown, which explorers at all times and of all ages have displayed. This spirit of adventure, to the fostering of which we in this Society have for generations been dedicated through our support of exploration, is the very antithesis of what I would call the "safety first" way of life. Enterprise, initiative, the willingness to chance your arm, to "have a go," these are the lessons which exploration teaches. The sharing together, moreover, of the dangers and the discomforts of exploration demands the submergence of self-interest in favour of the common good. All these qualities which exploration fosters—courage, initiative, enterprise, unselfishness—they are not only demanded in the field of exploration, they are vitally significant in every walk of life, and it is no coincidence that youthful experience of exploration has become a life-long inspiration in the careers of many famous men. We in this Society would greatly like to see these opportunities to share in exploratory experience immeasurably widened and opened not only to the youth of our schools and universities but to the apprentices and the learners and the young men and women of our great industrial organizations. We should like, indeed, to see them open to youth of every class and creed in this country and throughout the British Commonwealth. As I say this I look towards Sir John Hunt, Secretary of the Duke of Edinburgh's Award Scheme, for no one has done more to encourage youthful endeavour than our much travelled Honorary Fellow, Prince Philip the Duke of Edinburgh. One day perhaps the projects which he has done so much to encourage in this country will be extended to include the more remote countries overseas.

Now another great factor which we have in mind in our support of youthful expeditions is the fostering of international understanding. International understanding, Mr. Ambassador, among the youth of the world has never been more urgent than it is today. Indeed it would be no exaggeration to say that on it the future of the world depends. The fostering of international understanding, the building of close and sympathetic contacts, is not done only through our work in support of expeditions. It was as long ago as May 1830 that members of our Raleigh Club, the ancestor of our present Geographical Club, gathered together here in London to frame a constitution for a Geographical Society. Foremost among the aims of our Society was the following: "To correspond with similar Societies that may be established in different parts of the world; with foreign individuals engaged in geographical pursuits; and with the most intelligent British residents in the various remote settlements of the Empire." Even then we were insistent on some degree of intelligence! And these, Ladies and Gentlemen, are, in the changed circumstances of the times, still our most persistent aims. We are indeed in many ways not only a British, but a Commonwealth and international Society. Our Fellowship is not only British, it is Common-

wealth and international. Our Medals and Awards are not only British, they also are Commonwealth and international, and at no time during the year are our Commonwealth and international affiliations and sympathies better displayed than during the anniversary celebrations such as we are enjoying at this moment. On these occasions it is our special pleasure to welcome distinguished representatives and friends from the Commonwealth and from the wider borders outside—medallists and guests; and none, Mr. Ambassador, do we welcome more warmly than the representatives from your country with whom we have for so long had such intimate relations. May those relations long continue!

Sir JOHN HUNT: My Lord President, Your Excellency, My Lords, Ladies and Gentlemen.

We have, as you have seen displayed in front of you along this table and elsewhere, an exceptional galaxy of distinguished guests as well as medallists here this evening, and it is my exceptional privilege to propose their health.

Now I propose to take the medallists and our principal guests alphabetically, and I should, by right of seniority and by other rights as well, put first into bat His Excellency the American Ambassador, starting with A, had he not already batted a good innings, and been bowled out by our President. So I come to the second in order of alphabetical seniority, and how appropriately, to our very distinguished Patron's Medallist, Commander William Anderson of the United States Navy. As all the world knows, William Anderson sailed the *Nautilus* on her epic journey of some 8000 miles between Honolulu and Europe, of which some 1800 miles were sailed submerged from off Point Barrow in Alaska to a point between Greenland and Spitsbergen under the North Pole and beneath the Arctic ice. Now you, Sir, have heard a great many tributes no doubt of this nature and you will be gladly spared any more of them this evening. But I am perfectly certain that your many admirers and friends here would not allow me to let you get away without one more. In an age when a tremendous importance, in fact a premium, is placed on sensationalism, you have, Sir, performed a feat which is far more than a sensational stunt—far more significant, I suggest, than the latest gambit in global military strategy, far more valuable even than the fact that you have pioneered the shortest sea route between two continents and perhaps made the beginnings of what may be a highway for the submarine freighters of the future. I would suggest that far more important than any of these things, and certainly most of all to this Society, is the fact that you have charted the exciting mountainous Arctic landscape beneath the Arctic ice, and you have set one more much needed example, as so movingly mentioned by our President just now, in the world today of daring and the adventurous spirit translated into modern terms. It seems to all of us, I am sure, a most happy coincidence that Anderson and his crew, representing our greatest ally, should have made their trans-Arctic crossing within a few months of the first crossing of the Antarctic by our Commonwealth party.

We come next in alphabetical order to, and welcome very warmly tonight, Sir Maurice Bowra. We welcome Sir Maurice as we welcomed his predecessor in office two years ago, Sir George Clark, as President of the British Academy. Now, as most of us know, Sir Maurice is a most distinguished administrator and scholar; he was a former Vice-Chancellor of the University of Oxford and is presently Warden of Wadham. A poet, a classical scholar, and a modern linguist, his life seems to be so full of rich gifts and diverse talents that when you come, at the end of a very long entry in 'Who's Who,' to the word "Recreation," you find (possibly not suprisingly) the word "None."

We are especially delighted to welcome also here tonight Professor S. P. Chatterjee of Calcutta University. He has been awarded the Murchison Grant by our Society for his great work in directing the recently published first 'National Atlas of India,' and he is the first of his countrymen to have been awarded a major grant by this Society since the independence of his country. Speaking very personally, Sir, it gives me particular pleasure to claim Professor Chatterjee as a distinguished son of Bengal,

where I served for a number of years in the Police and in the Army between the Wars, and where my wife and I have many friends.

We have with us here tonight the Chief of the Imperial General Staff, General Sir Francis Festing. As one who only until recently was hanging precariously from one of the lower branches of the hierarchical army tree, and who is still a reserve officer in these troubled times, I must be careful what I say. I must restrain the temptation to reveal to you some of the choicest stories about Frankie Festing to which I have access from the privileged position of a brother Rifleman. To this Society Sir Francis commends himself most particularly as a bold and skilful ocean yachtsman. And in his own profession and throughout his service he has endeared himself to all ranks—seniors, equals and juniors—for just being himself.

In Sir Raymond Priestley we have as our Founder's Medallist this year one of our most illustrious Fellows. He is, as the President has pointed out, and as we all probably know, the doyen of polar explorers. He is now in the unique position of having been twice to the Antarctic before the first War, first with Shackleton and then with Scott, and he has kept up his interest, his active interest, in the polar regions ever since. He is also, as we know only too well, a very distinguished administrator, having been a Vice-Chancellor of two universities, Melbourne and Birmingham. He would be the last to think so himself, but to his many friends and admirers here the recognition that we have given him by granting him (with the permission of the Queen) the Founder's Medal this year is, to say the least of it, slightly overdue. Sir Raymond Priestley is not only a man of great deeds but, I believe, of many words. He accompanied His Royal Highness Prince Philip during the voyage of the *Britannia* into the Antarctic a couple of years ago where, I understand, he was nicknamed by His Royal Highness firstly the "Lesser Polar Backchat" and later on as they approached the pack ice so voluble did Sir Raymond become that he was promoted by His Royal Highness into the senior species of the "Greater Polar Backchat."

And then we have here to honour this evening Gerald Seligman, the third in the trio of medallists from the glacial regions tonight, who has won the Victoria Medal for his work as a glaciologist. He is founder of our Glaciological Society and now its President. I feel rather more on familiar terms with Gerald Seligman than with some of the other distinguished people I have been talking about tonight, not only because we are fellow Members of the Alpine Club and other climbing societies, but because he is interested not only in ice caps but in glacial streams which flow steeply downhill. Having some experience of glaciers myself both on the surface and (unfortunately) in the interior I look forward to the day when Seligman will provide the ignorant climber with an infallible means of avoiding falling into a crevasse. When he does this to my satisfaction I shall have great pleasure in recommending to our Council that we give him another medal.

Commander W. R. ANDERSON: My Lord President, Your Excellency, My Lords and My Ladies, Sir John, Distinguished Guests and Fellows of the Royal Geographical Society.

I know of no organization which so fully represents the pioneering efforts of mankind as the Royal Geographical Society. In no organization is there such a full and rich heritage of man's voyages by every medium into unknown realms of geography and exploration. The achievements of this Society, through its sponsorship and encouragement of exploration of every type, are a very foundation of man's continuing search for a better understanding and a greater harmony with the physical world in which we live. There seem to be this evening an unusual number of ice-men here. Mr. Gerald Seligman has made the great glaciers of the world his laboratory. On many expeditions involving countless physical hardships, hardships which he himself has reported on most modestly, he has brought back to the world a greatly increased understanding of one of the most startling of nature's phenomena, the phenomenon of the glacier. Sir Raymond Priestley has dedicated his life to the service of his country in a career ranging from the field of battle in a surprisingly broad reach into

the fields of education and exploration. The only survivor of both the Scott and the Shackleton expeditions, his avid pursuit of polar exploration and his studies of Antarctica have captured the admiration and respect of millions throughout the world.

Now I would like to pause to note a marked comparison between those who have been honoured this day. Most have been involved, as I mentioned, in cold weather work. But how do you compare further? Gerald Seligman has, in the pursuit of his studies, endured many weeks of nagging intense cold; the cruise of the *Nautilus* was made in shirt-sleeve comfort; Sir Raymond Priestley, I have it reliably reported, on one occasion removed his windproofed trousers to find that they stood up rigidly at attention frozen stiff. But there is one way in which all of us stand solidly together, and that is in our grateful appreciation of the honours the Society has rendered us. Common to us all is our humble pride in being so honoured and our full awareness that no act of exploration would be possible without the solid backing and enthusiastic support of those who remain behind.

I have been asked to talk a little bit about the voyage of the *Nautilus*. It is strange to me how often it is that success is underwritten by failure, or at least by events which we might temporaily interpret as being failures. The nineteen-day trans-Polar voyage of the *Nautilus* from Honolulu to Portland in July and August of last year was executed cleanly, rapidly and decisively. But few people are aware that this marked success was made possible by events that had transpired through the years before and by getting our troubles behind us before the voyage itself. The first of two preliminary voyages took place in 1957 when we were hurriedly fitted out for exploratory under-ice operations in August of that year. The intention of that cruise was to penetrate, if feasible, the ice for about 200 miles north of the Greenland Sea, proceeding to latitude 83° North. One of our means of preparing for our limited stay in the north was to make up a detailed check-off list of things that we should do, observations that we should make, during the brief period of the operation. I encouraged my officers to use their initiative in making additions to this list and on the day of sailing I gave it a final review, noting two late entries made by one of my young officers. Number 178 read as follows: "Upon arrival at the North Pole put the rudder hard over and make twenty-five complete turns thus becoming the first ship in history to make twenty-five consecutive trips around the world in one hour." Number 179 was a detailed procedure on how to catch a polar bear. This cruise in 1957 was marked by many items of experience in under-ice operating techniques and by proceeding to latitude 87° North, about twice as far as we had initially hoped; due, let us say to some confusion in navigation, it was also notable for an unscheduled visit to an ice-locked harbour in northern Greenland. This was an experience that none of us who made the cruise will soon forget, but I think that I was much more worried about a small collision that we had with the ice in doing our first surfacing, within the ice pack, a collision which resulted in putting out of service both our periscopes and in smashing down the top of the surrounding superstructure. My concern was not the seriousness of the damage, for we were later able to repair one of the periscopes, but how to explain away the damage when we arrived in Portland. For the fact that the *Nautilus* had been probing the ice pack was at that time very secret information. But when we arrived in port and, just as I expected, people started to ask what had happened to the upper works of the *Nautilus*, the crew, thoroughly briefed, said simply, "Oh well, we ran into some rough water." They did not bother to explain that this water was frozen. Altogether the 1957 cruise was successful, not in terms of spectacular accomplishments, but in terms of information obtained, lessons learnt and in the gaining of enthusiasm from our President and from our Navy for a major Arctic cruise in 1958.

I know of no quality in man that is to be quite so much admired as determination, the quality shown by those who, like Sir Raymond Priestley, Sir Vivian Fuchs, Admiral Peary and many others, have sought their goals over the ice. When we arrived at the North Pole last August in the *Nautilus* my thoughts were very much with the remarkable expeditions that had preceded us; one could not help but draw a rather marked

comparison. The early polar explorers had sought their goal over many years of heroic effort. The total of our own efforts embraced but a period of months. Like those who had preceded us we had had trials and disappointments, but ours were as one in one thousand compared to the trials and disappointments known by so many in the Arctic and in Antarctica. The men who arrived at the North Pole and the South Pole, by foot, in sledge or snow-mobile, did so after many weeks of painfully slow travel; in the *Nautilus* we were, thanks to nuclear power, travelling at a rate such that we would cover in minutes a distance equal to their best full day's travel. Their path was over and around incredibly rugged hummocks and ridges, around or across remarkably treacherous leads or crevasses. Ours was in a medium of incomparable consistency and smoothness; theirs to endure weeks of darkness or semi-darkness; ours was a world of atomic created light, available always at the flip of a switch. Their navigation instruments were a pocket watch and a sextant; ours a maze of mechanical and electronic devices that constantly revealed with great accuracy our position and our progress. Theirs was a world of incredible hardness, temperatures down to 50 and 60 below, hard driving winds, blinding snow; ours was a world of atomic plenty. Perhaps a major aspect that made the voyage of the *Nautilus* comparable in any degree to the operations that have been carried out on the surface was the fact that our environment did not open up, did not become unveiled to us, until after we had in some cases entered it. For example, we did not know that we were passing the ice off Alaska with only five feet of overhead clearance until the upward beam sonar registered five feet. Nor did we know that we would pass an 8000 feet uncharted mountain range until we were in fact passing it. Nor did we know that our navigation would prove accurate and reliable; but thanks to the miracle of nuclear power, modern electronics and team work, team work by 116 men, *Nautilus* was able to go through this new and significant sea route.

True achievement is seldom possible without the work of those who have gone before; in this respect today's nuclear submarine service and indeed our entire navy owes a special debt of gratitude to those who have preceded us in this exploratory work. Their findings are our basic ingredients in today's submarine polar operations. The nuclear-powered submarine is indeed a versatile craft. Those of us in our own Service beneath the sea look forward most eagerly to being joined by Britain's *Dreadnought*, named so appropriately to reflect the inevitable course of a line, a new line, of capital ships of the Royal Navy, of ships capable of operating truly within the full dimensions of the sea. In receiving the Patron's Medal I would like to say that I consider it something more indeed than a personal honour. I consider that I receive it as a mark of the great friendship of our nations, and that I receive it with the utmost feeling of respect to Her Gracious Majesty. To the President, and to the officers and members of the Royal Geographical Society, and indeed to all the people of Britain on behalf of *Nautilus*, a ship, a wonderful ship, all her officers, all her crew, her designers, her constructors and the thousands and thousands of people who have supported her, thank you very much.

General Sir Francis Festing: My Lord President, Your Excellency, Ladies and Gentlemen.

I would like to say how very honoured we, your guests, are to be here on this memorable occasion and also to be dining in the presence of so many distinguished people and explorers. We do want to reiterate our respect for all that has been done by your great Society ever since its foundation. I do not think that there has been any major expedition that has come from this country during over a hundred years that has not been assisted and very often sponsored by your Society. Speaking as I do for the Army I would like to say that we have received your help in the recent Army Expedition to French West Africa in 1958, and also in the expedition to Libya which took place fairly recently and finally in the British-Pakistani Expedition to Rakoposhi, and that has been a tremendous help to all of us to be supported by this Society. You have also helped us tremendously, we in the Army, over our special equipment and rations, and in a modern army today I can assure you, Ladies and

Gentlemen, that that assistance is of immense value and it is something that I would like to take this opportunity to thank the Society for. We are very proud of the links that bind you in the Royal Geographical Society to the Army. And we are particularly proud because I think that the Army needs those very qualities that your President has drawn attention to in his speech. I am sure that it is those qualities of adventure, resource and so on that are going to make, as they always have done in the past, a tremendous contribution to the Army. We are now passing from a period of National Service to a resurgence of the Regular Army, and if we can rely, as I know we can, on your assistance and help it will help us in achieving a good Regular Army, which must be based on a spirit of adventure because otherwise it will not be a very good army. I would at this point like to pay tribute to the young men of this country and to the young men throughout the world. I think that many of us as we get older are rather inclined to feel that the young man of today does not perhaps possess the same qualities and the same spirit of adventure that we like to think that our contemporaries some time ago possessed; speaking as one who has seen quite a lot of the young men today I think that we are wrong. There is plenty of adventure, there is plenty of spirit of endurance, plenty of these qualities that go towards the many expeditions and the many explorations that have been carried out under your aegis.

Sir MAURICE BOWRA: My Lord President, Your Excellency, My Lords, Ladies and Gentlemen.

I am greatly honoured at being asked to help to reply to this toast, but I feel myself immeasurably unqualified to do so. To answer on the one hand a toast proposed by Sir John Hunt who has walked on the roof of the world, and answered by Commander Anderson who has literally turned on the very axis of the world itself, is not one to which I am at all well suited. My own travelling is of limited kind. I once walked to the top of Parnassus and it was worth it although there were no Muses singing on the top. There were, on the other hand, a large number of carnivorous Greek dogs who were most easily dealt with by sitting back on one's haunches and barking back at them. I have also, before the days of D.D.T., travelled extensively in various parts of Greece, which is the only country I know at all well, and suffered from those red and black animals, which Baedeker described as "the enemies of repose." Reading the other day the life of a Byzantine saint I discovered the following episode. The saint, travelling in the Peloponnese, arrived at a village and asked for a bed at a private house and was given it. The bed was occupied. He put up a prayer and the occupants walked out and formed a neat little line by the door. In the morning instead of the bed being free, as it should be according to good Greek manners, the host insisted on being paid for it. The saint unwillingly paid, put up another prayer, and the occupants walked back. Those are, I am afraid, the limits of my travels and you see how poor they are. This great Society belongs to the enormous tradition of discovery, which is surely one of the things to which man was born and bred. As one looks over the centuries every change in human life has been accompanied by some greater knowledge of the world in which we live. And one looks back beyond the great heroic names, beyond Cook, beyond Drake, beyond Magellan, beyond Columbus, beyond Vasco da Gama, to still remoter but yet possibly more important names, to the Maoris who went over a thousand miles to New Zealand in open canoes, to Leif Ericson who, after all, discovered America, and beyond him to Hanno, the Carthaginian who went round Africa and only knew that something had gone wrong when the sun rose on the wrong side. These are the great pioneers, just as on land one looks in our own time behind Sir Aurel Stein who crossed the Karakoram in winter and lost his toes from frostbite at the age of seventy from doing so. Beyond him to Livingstone who really invented Africa, which hardly existed before him; to the missionary friars who thought nothing of walking across the whole of Asia in search of the Great Khan. To the Nasermonians, heard of at third remove by Herodotus, who walked across the Libyan desert and found very little men living in a wooded country in a large city with a river flowing to the east full of crocodiles; was it the

Niger, was it the Bahr-el-Ghazal? We are not sure. Anyhow, it was a great discovery. And beyond all that there are still the unknown explorers, the boats that foundered at sea, the travellers who died in the deserts or forests. Even further back to that primeval character, whom I like to think about, who, standing on the Asiatic shore of the Bering Strait, looked across it, decided to cross it and became the first American. Now in our time we hear, not so much about this world, which is the only one we know of and is in my view quite good enough, as about other ones. And I am happy to think, and I hope you will agree with me, that a geographical society has probably got far more to offer us than any future selenological society which will tell us about the vast dust heaps on the moon. The moon, apart from its very disagreeable climate, seems to offer nothing in the way of anything growing, or anything alive, and to provide really nothing but extremely sharp non-Alpine climbs. I have no desire to go there and I hope that the Royal Geographical Society will not support the moon as long as the earth is here without it. How long that is going to be I do not know, and I can offer you no promises, it depends entirely on the scientists over whom I have no control. In our world I still think there is an enormous amount to be discovered. I have yet to be persuaded that South America is adequately known, or that New Guinea has been properly explored, or that many people indeed have been in the middle of Formosa. These are quite small targets, but they clamour to be met and to be looked at and to be known. Surely there is an endless amount to be done. The world is still only partly charted, as anyone who sails in Greek waters knows. However good the Admiralty was in 1812 when the last charts were made, the rocks have moved since. The desire to know the world in which we live is one of the most heroic and splendid instincts in the human race. Indeed, at a time when other forms of active endeavour are becoming more and more difficult and sometimes more and more discredited, this seems to me the real heroic life, the life which makes a man realize all his faculties in action, in decision, in foresight, in endurance. I call to mind the great words in Dante's Divine Comedy when Ulysses, suitably placed in Hell, tells his own story. Fed up with his wife in his own home at Ithaca he puts out into the endless ocean beyond the Pillars of Hercules. His men are a little worried and despondent, and he summons them to action and says, "Remember the breed of which you were born, you were not made to live like brutes, but to pursue virtue and knowledge." It is in the pursuit of virtue in the form of action, and in the pursuit of knowledge through all that action brings and does to enrich our experience, our confidence, our feeling of being at home in our planet, that the great explorers, the great climbers, the great submariners, have contributed so much. It is that enormous endeavour to which this Society has given so much, to which it will give, I am sure, even more. It is therefore with the greatest pleasure that I, like all your other guests, am most moved and delighted to be with you here tonight.

INDEX

Capitals in main heading denotes articles and papers. Italics denotes books reviewed.
Short notes in single quotes

Abruzzi, Duke of the, and Mount Baker, Ruwenzori, 370 *et seq.*
Adelaide, Univ. of, news, 130
Aden: Sir T. Hickinbotham, 255
Africa, Science in development of: E. B. Worthington, *rev. art.* by G. C. L. Bertram, 98–9
Africa, North, Cambridge Expedn. to Apollonia, 456
Africa, north-west (Magrib), Survey of: ed. N. Barbour, 430–1
Africa south of Sahara, Population pressures in: R. W. Stephens, 433
Africa, West, *Black man's palaver:* I. Ryan, 111; *Black star rising:* R. W. Howe, 111
African administration, Journal of, Vol. 10 no. 4: H.M.S.O., 428–9
Agriculture, Introduction to tropical: Sir. H. Tempany and D. H. Grist, 270–1
Ahmad, N., *Economic geogr. of East Pakistan,* 256–8
Air photography, *Aerial photography and map-making:* L. Hurault, 444; *Landscape from the air:* F. J. Monkhouse, 445
Akademie für Raumforschung und Landesplanung, *Historische Raumforschung* I and II, 271–2
Akester, A. R., SAHARAN SURVEY (*title only*), 147
Alaska, Landscapes of: H. Williams, 112
Albatros, and Survey of South Georgia, 23
Alps, Great motor highways of: H. Merrick, 123
Amazon, *Across river of death:* J. Bisch, 264
Ambach, W., and others, *Zeitschrift für Gletscherkunde und Glazialgeologie,* Band 4, Heft 1–2, 440
America, Equatorial, *Graciela to head-hunters:* A. Boeldeke, 264
America, Latin, Statistical abstract of, 1957, 284
America, North, *Canada and her neighbours:* D. J. Sievewright and T. Lloyd, 112–13
America, North, *Introduction to historical geology,* 2nd edn.: R. C. Moore, 113–14; *Southeast in early maps:* W. P. Cumming, 263–4
Amer. Geogr. Soc., receives Lord Nathan, 125; presented with Gough Map, 125
Andalusia, *see* Ibn Baṭṭūṭah
Anderson, J. A., and exploration in Borneo, 305
Anderson, S., and J. Palliser, 163
Anderson, W. R., Patron's Medal to, 278, 478; remarks at A.G.M., 478; speech at Annual Dinner, 486–8
Anderson, W. R., and C. Blair, *Nautilus* 90 *North,* 451
Andes, Pumasillo, *Puma's Claw:* S. Clark, 277
Angkor: M. MacDonald, 427
Antarctic, climate, 343 *et seq.*; Gough Id., *Mountains in the sea:* M. Holdgate, 116–117; gravitational investigations, 351 *et seq.*; HYDROGRAPHIC SURVEY IN FALKLAND IDS. ANTARCTIC DEPENDENCIES: C. J. Wynne-Edwards (*title only*), 147; ice mass balance, 343 *et seq.*; *Norwegian-British-Swedish Antarctic expedn.,* 1949–52, *scientific results. Glaciology:* C. Swithinbank, V. Schytt and G. de Q. Robin, *rev. art.* by J. W. Glen, 239–43; seismic investigations, 351 *et seq.*; ANTARCTIC SNOW AND ITS CLIMATE: H. Lister (*title only*), 147; SOUTH GEORGIA, SURVEY OF: D. Carse, 20–37; ANTARCTIC VOYAGE OF M.V. *Thala Dan:* P. Law, 326–42; *see also* South Pole
ANTARCTICA AND I.G.Y.: G. R. Laclavère (*title only*), 147; *Crossing of:* Sir V. Fuchs and Sir E. Hillary, *rev. art.* by A. Croft, 93–5; *Antarctica today and tomorrow:* G. C. L. Bertram, 115–16; VARIATIONS OF ICE MARGINS IN EAST: M. Mellor, 230–5
APOLLONIA, UNDERWATER EXPLORATION OF ANCIENT: N. C. Flemming (*title only*), 292
Arabia, Archaeological discoveries in south: R. L. Bowen, 254–5; Society's map of, Southern, 294
Arctic, Durham Univ. Explor. Soc. Expedn. to Norwegian Arctic, 132–3; history, *In quest of North-west Passage:* L. H. Neatby, 450; *Nautilus* 90 *North:* W. R. Anderson and C. Blair, 451; *Russians in:* T. E. Armstrong, 253–4; *School-house in:* M. Hinds, 451; TRANS-POLAR VOYAGE OF U.S.S. *Nautilus*: W. Lyon (*title only*), 148, 291; "vegetation arcs," letter on, 144–5; *Venture to Arctic:* ed. R. A. Hamilton, 114–15
Argentino, Lake, Patagonia, 314 *et seq.*
Arid zone research, Vols. IX, X and XI: UNESCO, 269–70
Armstrong, T. E., *Russians in Arctic,* 253–4
Arneb, U.S.S., off Wilkes Station, 332
Arnold, G., *Longhouse and jungle,* 426–7; and Oxford Usun Apau expedn., 305
Arrowsmith, J., map of British N. America, and J. Palliser, 154, 164
Ashanti: a proud people: R. A. Lystad, 431–432
Ashton, P., botanical research, Brunei, 308
Ashwell, I. Y., *see* Hannell, F. G., and I. Y. Ashwell
Asia, *View to the south-east:* S. R. Rau, 106–7; *High road to Hunza:* B. Mons, 449
Assam, *Secret lands where women reign:* G. Bertrand, 107
Assyrian Excavation Fund, 197
ASSYRIAN SCULPTURES IN COLLECTION OF ROYAL GEOGR. SOC.: R. D. Barnett, 197–8
Astbury, A. K., *The Black Fens,* 100–1

Atacama, *see* Puna de Atacama
Atacama Desert, Cambridge expedn., 1958, 133, 401 *et seq.*
Atka, U.S.S., ice-breaker, in Antarctic, 332
Atlantic: L. Outhwaite, 116
Atlas, Times, of World: ed. J. Bartholomew, 273–4
Auckland Univ., news, 454–5
AUSTERDALEN, NORWAY, GEOMORPHOLOGY IN: C. A. M. King, 357–69
Austerdalsbre, Norway, Cambridge expedn., 1955, 357
Australian Govt., Antarctic Div. External Affairs, charters *Thala Dan*, 326
A.N.A.R.E., 1958 relief of stations by *Thala Dan*, 326 *et seq.*; and glacier retreat at Heard Id., Antarctic, 230, 232
Austria, *Klimatographie von Österreich:* ed. F. Steinhauser and others, 424–5
Avalanche: J. Wechsberg, 268–9

Baker, Mount, *see* Ruwenzori
Ball, J., and J. Palliser, 149, 156, 157, 162
Banks, A. L., STUDY OF GEOGRAPHY OF DISEASE, 199–216
Banks, M. E. B., awarded M.B.E., 125; and J. Mills, ASCENT OF RAKAPOSHI (*title only*), 477
Barbour, G. B., KITIMAT, 217–22
Barbour, N., ed., *Survey of north-west Africa* (*Magrib*), 430–1
Barcelona with love: C. King, 276
Barnes, M., ed., *Mountain world*, 275–6
Barnett, R. D., ASSYRIAN SCULPTURES IN COLLECTION OF ROYAL GEOGR. SOC., 197–8
Bartholomew, J., ed., *Times atlas of world*, 273–4
Bartram, W., *see* United States
Batho, G. R., TWO NEWLY DISCOVERED MANUSCRIPT MAPS BY CHRISTOPHER SAXTON, 70–4
Batu Lintang Training College, Kuching, and crossing of Usan Apau, 309
Baume, L., mountaineer, Survey of South Georgia, 25 *et seq.*
Bavaria, *Die Neuauslotung des Chiemsee-beckens:* F. Wilhelm, 423–4
Bechuanaland, *The big thirst:* C. Kantor, 111
Baṭṭūṭah, *see* Ibn Baṭṭūṭah
Beaujeu-Garnier, J., *Géographie de la population*, Tome 2, 270
Belfast, Queen's Univ. expedn., 1957, *see* Spitsbergen
Bell, R., Canadian Geol. Surv., and J. Palliser, 163–4
Berlin, East, A. von Humboldt commemoration and Geogr. Conference, 455–6; West, A. von Humboldt commemoration and 32nd German Geogr. Congress, 455
Bertram, G. C. L., "African opportunity," *rev. art.*, 98–9; *Antarctica today and tomorrow*, 115–16
Bertrand, G., *Secret lands where women reign*, 107
Birds, and climatic changes, 5–9
Birdwood, Lord, 'History of Pathans,' *rev. art.*, 414–16
Birmingham and Exeter Univs. joint Expedn., *see* Spitsbergen
Bisch, J., *Across river of death*, 264
Black, 'Atlas of North America,' 154
Blair, C., *see* Anderson, W. R., and C. Blair
Blake, P. W., and others, *The Norfolk we live in*, 449
Blakiston, T., with Palliser expedn., 156, 158, 165
Boateng, E. A., *Geogr. of Ghana*, 431
Bodleian Library, and Gough Map, 294
Boeldeke, A., *Graciela to headhunters*, 264
Bomford, T., surveyor, Survey of South Georgia, 25 *et seq.*
Bopegamage, A., *Dehli*, 256
Borneo Airways, 301
Borneo, Evangelical Mission, and air strips in Borneo, 301; EXPLORATION IN CHANGING BORNEO: T. Harrisson (*title only*), 146; INNERMOST BORNEO: TEN YEARS' EXPLORATION AND RESEARCH: T. Harrisson, 299–311; North Borneo Government, and aviation in Borneo, 301; *World within: Borneo story:* T. Harrisson, 426–7
Bostock, H. S., and D. M. R. Rowley, obit. of C. Camsell, 287–8
Botanical exploration to the time of Linnaeus: W. T. Stearn, 447
Bourdon, J., *see* St. Lawrence, Bourdon plans. . . .
Bourgeau, M., botanist with Palliser expedn., 156, 159
Boutcher, W., and Assyrian excavations, 197
Bowen, M., geological research in Borneo, 309
Bowen, R. L., *Archaeological discoveries in south Arabia*, 254–5
Bowen-Jones, H., *see* Fisher, W. B., and H. Bowen-Jones
Bowling, H. G., *Land of three rivers*, 101
Bowra, Sir M., speech at Annual Dinner, 489–90
Boyd, M., *Much else in Italy*, 123
Boyes, J., and Cambridge Expedn. to North Borneo, 308
Brathay Exploration Group, and Austerdalsbre, Norway, 357
Bratt, G., with Shipton in Patagonia, 312 *et seq.*
Brisbane, Univ. of, news, 130
Bridge, A., and S. Lowndes, *Selective traveller in Portugal*, 276
British Assocn., York meeting, 1959, 137; note by M. J. Wise, 456–8
British Columbia, hydro-electric power, KITIMAT: G. B. Barbour, 217–22
British iron and steel industry: H. R. Schubert, 100
British Isles, Celtic lands, *Géogr. rurale de quatre contrées celtiques: Irlande, Galles, Cornwall et Man:* P. Flatrès, 245–6
British Museum, Trustees of, aid to Shipton expedn. to Patagonia, 312
British ports and shipping: H. Rees, 101–2
British weather in maps: J. A. Taylor and R. A. Yates, 102
Brittain, R., *Rivers and man*, 441
Brown, W., *Peruvian adventure*, 264
Bull, C., and gravity survey, Austerdalsbre, Norway, 359
Burton Island, U.S.S., ice-breaker, in Antarctic, 332

Busk, Sir D. L., made K.C.M.G., 452
Butland, G. J., appointed to chair of geogr. Univ. of New England, N.S.W., 454
Butzer, K. W., SOME RECENT GEOLOGICAL DEPOSITS IN THE EGYPTIAN NILE VALLEY, 75–9; *Studien zum vor- und frühgeschichtlichen Landschaftswandel der Sahara*, 109–110

Calder, R., *Men against the desert*, 110
Calouste Gulbenkian Foundation, grants for equipment, 294
Cambridge expedns., *see* Africa, North; Atacama Desert; Austerdalsbre, Norway; Greenland; Spitsbergen
Camoens Awards 1959, Conditions for, 284
Campbell, R. M., remarks at A.G.M. on receiving Mrs. Patrick Ness Award on behalf of J. H. Miller, 480
Camsell, C., obit. by H. S. Bostock and D. M. R. Rowley, 287–8
CANADA, CAPTAIN JOHN PALLISER AND EXPLORATION OF WESTERN: I. M. Spry, 149–84
Canadian Geol. Surv., and J. Palliser, 163–4
Canvey Island: B. Cracknell, 420–1
Carey, Maj.-Gen. L. F. de V., made C.B., 125
Caroe, Sir. O., *Pathans*, 414–16
Carr, A. P., *see* Kidson, C., and A. P. Carr
Carrington, R., *Elephants*, 121; *Tears of Isis*, 450
Carse, D., SURVEY OF SOUTH GEORGIA, 20–37
Carter, G. S., and Kinabalu National Park project, 309
Cartographers, Training of, letters on, 140–2
Cartography, History of, TWO NEWLY DISCOVERED MANUSCRIPT MAPS BY CHRISTOPHER SAXTON: G. R. Batho, 70–4
Cartwright, G., U.S. Observer at Mirny, Antarctica, 333
Casey, R. G., official farewell to *Thala Dan*, 326
Catto, Lord, of Cairncatto, obit. by L. P. Kirwan, 471–2
CAUCASUS MOUNTAINS OF U.S.S.R., CLIMBING IN: Sir J. Hunt (*title only*), 147
Central Asian Research Centre, and map of Soviet Central Asia and Kazakhstan, 462–3
Ceylon, Report of Land Commission, Government of, 425–6
Chad, Lake, note on former extent of, by A. T. Grove, 465–7
Chaplin, Commdr. J. R., and South Georgia, 20
Chatterjee, S. P., Murchison Grant to, 278, 479; remarks at A.G.M., 479–80; ed., *National Atlas of India*, 96–7
Cheal, J., with Survey of South Georgia, 22 *et seq.*
Cherry-Garrard, A., obit., 472
China, Flood tide in: C. P. Fitzgerald, 427–8; *Geography of:* W. Chung-chi, *rev. art.* by P. Wheatley, 407–11; *Lineage organization in south-east:* M. Freedman, 104–5
Chitral, Oxford Expedn., 133
Chung-chi, W., *Geography of China*, 407–11
Churchill, Sir. W., *foreword* to *History of Hudson's Bay Company*, 262
Clark, S., *Puma's Claw*, 277
Clifford, Sir M., letter on 'South Georgia Survey,' 291
Climate, Geogr. of: synoptic world pattern: J. Gentilli, 440–1
Cole, J. P., *Geogr. of world affairs*, 448
Common land, Royal Commission on, 1955–58. *Report* (1958): H.M.S.O., 250
Commonwealth Institute, note on, 471
COMMONWEALTH TRANS-ANTARCTIC EXPEDN., GEOPHYSICAL INVESTIGATIONS OF: H. Lister and G. Pratt, 343–56
Congo, Belgian, Westminster Hospital Scientific Expedn., 133
Conservation of natural resources: ed. G.-H. Smith, 442
Conservation of natural resources, The: R. C. Haw, 442
Cook, J., and South Georgia, 20
Corkill, N. L., made C.M.G., 125
Corner, E. J. H., scientific expedn. to North Borneo, 308
Cornwall, Journey through: L. T. Stanley, 277; *see also* British Isles, Celtic lands
Cotton, Sir C. A., knighted, 452
Cotton, J., with Shipton in Patagonia, 322 *et seq.*
Courtauld, A., obit. by Q. Riley, 286–7
Cracknell, B., *Canvey Island*, 420–1
Crisp, D. J., INFLUENCE OF CLIMATIC CHANGES ON ANIMALS AND PLANTS, 1–19
Croft, A., 'Trans-Antarctic journey,' *rev. art.*, 93–5
Crone, G. R., 'Founder of modern geography,' *rev. art.*, 405–6
Cumberland, K. B., NEW ZEALAND AFTER TWENTY YEARS: GEOGRAPHER'S VIEW, 38–47
Cumming, W. P., *Southeast in early maps*, 263–4
Cunningham, J., mountaineer with Survey of South Georgia, 25 *et seq.*

Darlington, P. J., *Zoogeography*, 243–5
Davy, A., *Four thousand miles of adventure*, 450
de Agostini, Alberto, Salesian priest, and Patagonia, 312
Delhi: A. Bopegamage, 256
Delhi–Moscow air services, note on, by B. R. Goodfellow, 468–9
Derbendi-Khan dam, Diyāla river, Iraq, 390
Derruau, M., *l'Europe*, 422
Deserts, *Das Bild der Wüste:* A. Gabriel, 441–2; *Men against the desert:* R. Calder, 110
Dickinson, B., with Shipton in Patagonia, 322 *et seq.*
Dingle, R., commander A.N.A.R.E. Davis Station, 333
Directorate Ordnance Surv., and map of Mount Baker, Ruwenzori, 370 *et seq.*
Directorate Overseas Surv., *Gambia land use* [map] 1:25,000. *Sheet* 14/11, *Mansa Konko*, 274–5
Diyāla, *see* Iraq, eastern
Donovan, J., with *Thala Dan*, 332 *et seq.*
Dumas, Sir L., and portrait of Sir D. Mawson, 298

Dunes, Egyptian Nile valley, 75 *et seq.*
Dunsheath, J., *Guest of the Soviets*, 451
Durham Univ. expedns., *see* Arctic; Iceland; Invernessshire; Newfoundland; Norway; Switzerland
Dury, G. H., ANALYSIS OF REGIONAL FLOOD FREQUENCY ON THE NENE AND GREAT OUSE, 223–9

East Anglia, hydrology, ANALYSIS OF REGIONAL FLOOD FREQUENCY ON THE NENE AND GREAT OUSE: G. H. Dury, 223–9
Ecology, INFLUENCE OF CLIMATIC CHANGES ON ANIMALS AND PLANTS: D. J. Crisp, 1–19
Edmonds, C. J., letter on 'Marshes of southern Iraq,' 144
Educational Productions Ltd., prize essay, 284
Egypt, *Bankers and Pashas:* D. S. Landes, 110–11; SOME RECENT GEOLOGICAL DEPOSITS IN THE EGYPTIAN NILE VALLEY: K. W. Butzer, 75–9
Eichhornia (water hyacinth) in Nile, 89–91
Elba, Island of: Geogr. Field Group, 423
Elephants: R. Carrington, 121
Ellice, E., and J. Palliser, 161–2
England, Northern, *Land of three rivers:* H. G. Bowling, 101
England and Wales, Rural depopulation in, 1851–1951: J. Saville, 418–19; *see also Midlands, West*
Essex, *The great tide:* H. Grieve, 420–1; *Essex and the sea:* K. Newton, 420–2
Ethiopia, *Mountains of Rasselas:* T. Pakenham, 450; *Ethiopia today:* E. W. Luther, 432–3
Ethiopian adventure: H. Rittlinger, 450
Europe, Northern, *Econ. geogr. of Scandinavian countries and Finland:* W. R. Mead, *rev. art.* by H. Myklebost, 411–13; *l'Europe:* M. Derruau, 422
Eversley, D. E. C., D. M. R. Keate and V. Shaw, *Overspill problem in West Midlands: studies in housing and industrial location*, No. 1, 247
Exeter Univ., joint Expedn. with Birmingham Univ., *see* Spitsbergen
Expedns. in field, 1958, 132–3, 456

Faegri, K., and Norwegian glaciers, 357–8
Falkland Ids. Dependencies Survey, *see* Antarctic
Fauna Preservation Society, 283
Fels, E., H. Overbeck and J. H. Schultze, eds., *Geomorphologische Abhandlungen*, 118
Fenland, *The Black Fens:* A. K. Astbury, 100–1; 465
Festing, Gen. Sir F., speech at Annual Dinner, 488–9
Fidler, P., geographer, western Canada, 153–4
Finland, *Imatra som naturevärdhet till och med* 1870*:* S. Hirn, 123–4; *see also* Europe, Northern
Finlay, J. E. B., made C.B., 125
Fisher, C. A., appointed to chair of geogr. Sheffield Univ., 454
Fisher, W. B., and H. Bowen-Jones, *Spain*, 252–3
Fitzgerald, C. P., *Flood tide in China*, 427–8
Flatrès, P., *Géogr. rurale de quatre contrées celtiques: Irlande, Galles, Cornwall et Man*, 245–6
Flemming, N. C., UNDERWATER EXPLORATION OF ANCIENT APOLLONIA (*title only*), 292
Fordham, Sir G., and C. Saxton, 70
France, catalogue of maps, 285
Freedman, M., *Lineage organization in south-east China*, 104–5
Fuchs, Sir V., awarded Scottish Geogr. Medal, 131; and Sir E. Hillary, *Crossing of Antarctica*, 93–5

Gabriel, A., *Das Bild der Wüste*, 441–2
Gambia land use [map] 1:25,000. *Sheet* 14/11, *Mansa Konko:* Dir. Overseas Surv., 274–5
Garnett, A., Univ. of Sheffield news, 128–30
Gates, H. F. A., made C.M.G., 125
Gay, P. A., and L. Berry, WATER HYACINTH: NEW PROBLEM ON THE NILE, 89–91
Geisert, H. L., *see* 'World population pressures'
Gentilli, J., *Geogr. of climate: synoptic world pattern*, 440–1
Geogr. Assocn., annual conference, 458
Geogr. Field Group, *Island of Elba*, 423
Geography, Classical tradition of: C. Van Paassen, 272–3
Geography, Econ., *Geogr. of commodity production:* R. H. Highsmith and J. G. Jensen, 443
Geography, Human, *Die Bevölkerung der Erde:* K. Witthauer, 120–1
Geography, Medical, STUDY OF GEOGRAPHY OF DISEASE: A. L. Banks, 199–216
Geography, Physical, 4th edn.: P. Lake, 437
Geography, Political, *Geogr. of world affairs:* J. P. Cole, 448
Geology, *Das Eiszeitalter:* P. Woldstedt, 266–7; *Elements of:* J. H. Zumberge, 437–8
Geomorphology, *Coastal and submarine morphology:* A. Guilcher, 118–19; *Geomorphologische Abhandlungen:* ed. E. Fels, H. Overbeck and J. H. Schultze, 118; *Klimamorphologie der Massengesteine:* H. Wilhelmy, 438–9; *Probleme der Oberflächenformung in Grossbritannien unter klimamorphologischer Fragestellung:* L. Hempel, 438–9
Gerasimov, I. P., lecture at Birkbeck College, 133–6
German Transit of Venus Expedn., and South Georgia, 20
Gersdorff, R. von, *Masznahmen zur Förderung der privaten Kapitalbildung im portugiesischen Reich*, 252
Ghana, Geogr. of: E. A. Boateng, 314
Gilbert, E. W., remarks on "Study of geogr. of disease," 210–11, 216
Ginsburg, N., and C. F. Roberts, eds., *Malaya*, 105–6
Glaciology, *Zeitschrift für Gletscherkunde und Glazialgeologie*, Band 4, Heft 1–2: W. Ambach and others, 440

Glen, J. W., 'Glaciological research by Norwegian-British-Swedish Antarctic expedn.,' *rev. art.*, 239–43
Goodfellow, B. R., note on Delhi–Moscow air services, 468–9; remarks on "Explorations in Patagonia," 325
Goodman, Sir V. M. R., made K.C.B., 452
Gottschalk, M. K. E., *see* 'Zeeuws-Vlaanderen, . . .'
Gough Id., *see* Antarctic
Gough Map, presented to Amer. Geogr. Soc., 125; *see also* next entry
Great Britain, Map of, circa A.D. 1360, *known as Gough Map:* E. J. S. Parsons and Sir F. Stenton, *rev. art.* by R. A. Skelton, 237–9
Great Ouse, *see* East Anglia
Greece, *Mani:* P. Leigh-Fermor, 251; *The Morea:* R. Liddell, 103; *The private sea:* P. Mayne, 251–2
Greenland, Cambridge West Greenland Glaciological Expedn., 132
Grierson, J., obit. of Sir H. Wilkins, 139–40
Grieve, H., *The great tide*, 420–1
Griffin, A. R., District Officer, Baram, Borneo, 303
Grist, D. H., *see* Tempany, Sir H., and D. H. Grist
Grove, A. T., note on former extent of Lake Chad, 465–7; *Land and population in Katsina province*, 108–9
Grover, J. C., P. A. Pudsey-Dawson and R. B. M. Thompson, *Solomon Islands*, 266
Guiart, J., *Espiritu Santo* (*Nouvelles Hébrides*), 436–7
Gulley, J. L. M., note on 'Historische geografie van Westelijk Zeeuws-Vlaanderen,' 463–5
Gullick, J. M., *Indigenous political systems of western Malaya*, 104–5

Hagafellsjökull Eystri (E. Glacier), Iceland, 84 *et seq.*
Hagavatn, Iceland, 84–5
Hamilton, R. A., ed., *Venture to Arctic*, 114–115
Hannell, F. G., and I. Y. Ashwell, RECESSION OF AN ICELANDIC GLACIER, 84–8
Hardy, J. R., and gravity survey, Austerdalsbre, Norway, 359
Harper, F., *Travels of William Bartram*, 114
Harrisson, T., awarded O.B.E., 125; EXPLORATION IN CHANGING BORNEO (*title only*), 146; INNERMOST BORNEO: TEN YEARS' EXPLORATION AND RESEARCH, 299–311; *World within: Borneo story*, 426–7
Harvey, P. D. A., and H. Thorpe, *Printed maps of Warwickshire*, 417
Haw, R. C., *The conservation of natural resources*, 442
Heaney, J., surveyor with Survey of South Georgia, 21 *et seq.*
Hector, J., geologist with Palliser's expedn., 153 *et seq.*
Hele, I., portrait of Sir D. Mawson, 298
Helfritz, H., *Yemen*, 255
Hempel, J., *Probleme der Oberflächenformung in Grossbritannien unter klimamorphologischen Fragestellung*, 438–9
H.M.S.O., *Journal of African administration*, Vol. 10 no. 4, 428–9; *Report of Nature Conservancy for year ended* 30 *Sept.* 1958, 249; *Royal Commission on Common Land*, 1955–58. *Report* (1958), 250
Herefordshire, *Valley on the March:* Lord Rennell, 256–7
Hickinbotham, Sir T., *Aden*, 255
Hillary, Sir E., *see* Fuchs, Sir V., and Sir E. Hillary
Highsmith, R. H., and J. G. Jensen, *Geogr. of commodity production*, 443
Hill, R., *Egypt in Sudan*, 429–30
Himalaya, *Mountains and a monastery:* P. Holmes, 108; north of, by air, note by B. R. Goodfellow, 468–9; Sherborne Kulu-Spiti Expedn., 133
Hindberg, K., captain of *Thala Dan*, 326 *et seq.*
Hindle, E., 'Geographical distribution of animals,' *rev. art.*, 243–5; obit. of J. E. T. Philipps, 473
Hinds, M., *School-house in Arctic*, 451
Hirn, S., *Imatra som natursevärdhet till och med* 1870, 123–4
Howe, R. W., *Black star rising*, 111
Holdgate, M., *Mountains in the sea*, 116–17
Holland, *see* Netherlands
Holland, G. S., Gill Memorial to, 278, 481; remarks at A.G.M., 481
Holmes, P., *Mountains and a monastery*, 108
Honduras, Exploration in, 132
Hong Kong and the New Territories, Land use in: T. R. Tregear, 106
Hong Kong gazetteer: T. R. Tregear, 428
Hong Kong, Univ. of, news, 281
Hoyte, C., death of, 133
Hudson's Bay Company, and J. Palliser, 152 *et seq.*
Humboldt, Alexander von: J. H. Schultze, *rev. art.* by G. R. Crone, 405–6; commemoration East Berlin, 455–6; commemoration West Berlin, 455
Hunker, H. L., *Industrial evolution of Columbus, Ohio*, 113
Hunt, Sir J., CLIMBING IN CAUCASUS MOUNTAINS OF U.S.S.R. (*title only*), 147; speech at Annual Dinner, 485–6
Hunting Technical Services Ltd., and irrigation project Diyāla, Iraq, 390, 396
Hurault, L., *Aerial photography and map-making*, 444
Hydrology, *Rivers and man:* R. Brittain, 441

IBN BAṬṬŪṬAH'S ANDALUSIAN JOURNEY: H. T. Norris, 185–96
Iceland, Imperial College Icelandic Expedn., 132; RECESSION OF AN ICELANDIC GLACIER: F. G. Hannell and I. Y. Ashwell, 84–8; Solheimjökuil, Durham Univ. Explor. Soc. Expedn., 133; Wye College Expedn., 133, 456
Ichthyology, *Of fish and men:* J. Miller, 123
Imago Mundi: Vol. XIV, 446
Imperial College, London, and Austerdalsbre, Norway, 359

Imperial College Expedn., *see* Iceland
India, National Atlas of: ed. S. P. Chatterjee, *rev. art.* by L. D. Stamp, 96–7
Industry, Cottage, *Country craftsman:* W. M. Williams, 418–19
Internat. Geophys. Year, UNESCO exhibition "Earth as planet," 126–7
Indonesia, Constitution and geogr. in, article by L. H. Palmier, 138
Institute of British Geographers, conference at Cambridge, 281
Internat. Congress of History of Discoveries, Lisbon, 1960, 283
International Geographical Congress, 470
Internat. Union for Conservation of Nature and Natural Resources, 283
Inverness-shire, Glen Affric, Durham Univ. Explor. Soc. Expedn., 133
Iraq Development Board, and Derbendi-Khan dam, 390
Iraq, EASTERN MARSHES OF MESOPOTAMIA: H. St.J. B. Philby, 65–9; INVESTIGATIONS INTO SOILS AND AGRICULTURE OF LOWER DIYĀLA AREA OF EASTERN IRAQ: C. W. Mitchell, 390–7; marshes of southern Iraq, letters on, 143–4
Ireland, *see* British Isles, Celtic lands
Ireland, Northern, *see* Peat, Commercial use of
Irrigation, and funeral memorials, Borneo, 307
Isachsen expedn. to Spitsbergen, 1909–10, 80 *et seq.*
Italia, Lo studio delle aree di mercato in: G. Tagliacarne, 422–3
Italian Geogr. Congress, Bari, 1957, 282
Italy, Much else in: M. Boyd, 123
Izvestiya All-Union Geogr. Soc. U.S.S.R., article on Royal Geogr. Soc. by L. P. Kirwan, 283

"Jamaica, Karstlands of," letters on, 281–91
James, P., with Shipton in Patagonia, 312 *et seq.*
James, T., on Gibraltar under Moors, 189
Japanese, occupation of Borneo, 299–300
Jennings-Bramly, W. E., presentation to Society of documents relating to Turco-Egyptian frontier dispute, 459
Jensen, J. G., *see* Highsmith, R. H., and J. G. Jensen
Johnson, J. H., COMMERCIAL USE OF PEAT IN NORTHERN IRELAND, 398–400

Kalimantan, 299 *et seq.*
Kantor, C., *The big thirst*, 111
Karakoram, Minapin-Karakoram Expedn. (Warr), 133
Kazakhstan, *see* Soviet Central Asia
Keate, D. M. R., *see* Eversley, D. E. C.
Kelabits of Borneo, 301 *et seq.*
Kennedy, F. B., MAPPING IN JAMES I LAND, VESTSPITSBERGEN, 80–3
Khartoum, Univ. of, news, 280
Kidson, C., and A. P. Carr, MOVEMENT OF SHINGLE OVER SEA BED CLOSE INSHORE, 380–9
Kinabalu, Mt., 308–9
King, C., *Barcelona with love*, 276
King, C. A. M., GEOMORPHOLOGY IN AUSTERDALEN, NORWAY, 357–69
Kirk-Greene, A. H. M., *Adamawa past and present*, 108
Kirwan, L. P., made Honorary Member of Nat. Geogr. Soc., Washington, 125; obit. of Lord Catto of Cairncatto, 471–2; obit. of W. P. G. Thomson, 474
Kitimat, *see* British Columbia
Klöpper, R., and J. Körber, *Rheinland-Pfalz in seiner Gliederung nach zentralörtlichen Bereichen*, 250–1
Kohl-Larsen, L., and South Georgia, 20
Körber, J., *see* Klöpper, R., and J. Körber
Krolki, K. J., *Facts about Sudanese*, 430

Laclavère, G. R., ANTARCTICA AND I.G.Y. (*title only*), 147
Lake, P., *Physical geogr.*, 4th edn., 437
Lamb, H. H., remarks on "Geophysical Investigations of Commonwealth Trans-Antartic Expedn.," 355–6
Land Commission, Government of Ceylon, Report of, 425–6
Landes, D. S., *Bankers and Pashas*, 110–11
Land use, *Historische Raumforschung* I and II; Akademie für Raumforschung und Landesplanung, 271–2
Laseron, C., obit., 474
Latin American Travel Fund, grant for research in Brazil, 295
Law, P., ANTARCTIC VOYAGE OF M. V. *Thala Dan*, 326–42
Lawman, T. W., *The long grass*, 111–12
Layard, Sir H. A., and Assyrian excavations, 197
Leach, D. L., with T. Harrisson in Borneo expedn., 304 *et seq.*
Learmonth, A. T. A., and medical geogr. in India and Pakistan, 206; remarks on "Study of geogr. of disease," 211–14
Leeds, Univ. of, news, 130
Leigh-Fermor, P., *Mani*, 251
Leningrad Arctic Inst., and drift ice, 2
Lewis, E. D., *Rhondda valleys*, 419–20
Lewis, W. V., letter on "Karstlands of Jamaica," 289; remarks on "Geophysical investigations of Commonwealth Trans-Antarctic Expedn.," 354–5
Liddell, R., *The Morea*, 103
Lister, H., ANTARCTIC SNOW AND ITS CLIMATE (*title only*), 147
Lister, H., and J. G. D. Pratt, GEOPHYSICAL INVESTIGATIONS OF COMMONWEALTH TRANS-ANTARCTIC EXPEDN., 343–56; *see* Pratt, J. G. D., and H. Lister
Lliboutry, L., on Viedma Glacier, Patagonia, 320–1
Lloyd, G., remarks on "Innermost Borneo: ten years' exploration and research," 310–311
Lloyd, T., *see* Sievewright, D. J., and T. Lloyd
Loftus, W. K., and Assyrian excavations, 197
Louisiana State Univ., coastal geogr. conference, 1959, 469
Lowe, G., Cuthbert Peek Grant to, 278, 480; remarks at A.G.M., 480

Lowndes, S., *see* Bridge, A., and S. Lowndes
Luther, E. W., *Ethiopia today*, 432–3
Lynam, E., and C. Saxton, 70–1
Lyon, W., TRANS-POLAR VOYAGE OF U.S.S. *Nautilus* (*title only*), 148, 291
Lystad, R. A., *Ashanti: a proud people*, 431–2
Lytton, Sir E. B., and J. Palliser, 162 *et seq.*

MacDonald, M., *Angkor*, 427
Macfadyen, W. A., letter on WATER USE SURVEY, 145–6
McGill Univ., Montreal, positions offered, 138
Machapuchare, Nepal, *Climbing the Fish's Tail:* W. Noyce, 449
Macpherson Robertson, launch with *Thala Dan*, 334 *et seq.*
Ma'dan, marsh folk of Mesopotamia, 66–7
Magrib, *see* Africa, north-west
Makerere College Ruwenzori Reconnaissance, 133, 370 *et seq.*
Malaya: ed. N. Ginsburg, and C. F. Roberts, 105–6; *Indigenous political systems of western Malaya:* J. M. Gullick, 104–5; *Temiar jungle:* J. Slimming, 107
Maling, D. H., letter on "Training of cartographers," 141–2
Mammals, and climatic changes, 9
Man, Isle of, Portrait of: E. H. Stenning, 248; *see also* British Isles, Celtic lands
Manley, G., remarks on "Geophysical investigations of Commonwealth Trans-Antarctic Expedn.," 355; on "Influence of climatic changes on animals and plants," 17–18
Mansa Konko, *see* Gambia
MAP, HISTORY IN A: E. M. Yates (*title only*), 477
Marine animals, and climatic changes, 9–12
Marsh, G. W., remarks at A.G.M., 480–1; *see also* Miller, J. H., and G. W. Marsh
Marshall-Cornwall, Gen. Sir J., conferred with Diploma of Fellowship by Royal Scottish Geogr. Soc., 131; historical note on Turco-Egyptian frontier, 459–62; remarks on "Influence of climatic changes on animals and plants," 16–19
Mason, P., *Birth of a dilemma*, 433–4
Mawson, Sir D., portrait of, presented to Society, 279
Mayne, P., *The private sea*, 251–2
Mayo, gorge and glacier, Patagonia, 322 *et seq.*
Mead, W. R., article "G. A. Wallin and Royal Geogr. Soc.," 458; *Econ. geogr. of Scandinavian countries and Finland*, 411–13
Melbourne, Univ. of, news, 130
Mellor, M., VARIATIONS OF ICE MARGINS IN EAST ANTARCTICA: 230–5
Mercer, J., with Shipton in Patagonia, 312 *et seq.*
Merivale, H., and J. Palliser, 156 *et seq.*
Merrick, H., *Great motor highways of Alps*, 123
Mesopotamia, *see* Iraq
Meteorology, Everyday: A. A. Miller and M. Parry, 119–20
Mexico, three-storeyed land: A. t'Serstevens, 435
Meynier, A., *Paysages agraires*, 425
Midlands, West, Overspill problem in: studies in housing and industrial location, No. 1: D. E. C. Eversley, D. M. R. Keate and V. Shaw, 247; *Pictorial survey of England and Wales: Section* VI: M. J. Wise, 247
Miles, P., with Shipton in Patagonia, 312 *et seq.*
Miller, A. A., and M. Parry, *Everyday meteorology*, 119–20
Miller, J., *Of fish and men*, 123
Miller, J. H., and G. Marsh, awarded jointly Mrs. Patrick Ness Award, 278, 480
Mills, J., *see* Banks, M. E. B., and J. Mills
Mitchell, C. W., INVESTIGATIONS INTO SOILS AND AGRICULTURE OF LOWER DIYĀLA AREA OF EASTERN IRAQ, 390–7
MONGOLIA, 1958: H. S. C. Smallwood (*title only*), 292
Monkhouse, F. J., *Landscape from the air*, 445
Mons, B., *High road to Hunza*, 449
Moore, R. C., *Introduction to historical geology*, 2nd edn., 113–14
Morgan, W. B., INFLUENCE OF EUROPEAN CONTACTS ON LANDSCAPE OF SOUTHERN NIGERIA, 48–64
Mountain glaciation, report by Amer. Geogr. Soc., 282
Mountain world: ed. M. Barnes, 275–6
Mount Everest Foundation, aid to Shipton expedn. to Patagonia, 312
Murchison, Sir R., and J. Palliser, 152, 154
Murray, G. W., and climatic history of Egypt, 75 *et seq.*
Myklebost, H., 'Econ. geogr. of "Norden",' *rev. art.*, 411–13

Nansen, F., and ice thickness in Arctic, 2
Nathan, Lord, PRESIDENTIAL ADDRESS, 1959, 293–8; remarks at A.G.M., 477 *et seq.*; remarks on "Explorations in Patagonia," 325; on "Innermost Borneo: ten years' exploration and research," 310–11; speech at Annual Dinner, 483–5; visit to U.S.A., 125; presents Gough Map to Amer. Geogr. Soc., 125
Nature Conservancy: first ten years: Nature Conservancy, 249; *Report of, for year ended* 30 *Sept.* 1958: H.M.S.O., 249
Nautilus, U.S.S., *see* Arctic
Navigation, Art of, in England in Elizabethan and early Stuart times: D. W. Waters, 418; *Give me a ship to sail:* A. Villiers, 277; history of, *Caravels of Christ:* G. Renault, 446
Neatby, L. H., *In quest of North-west Passage*, 450
'Negev, Ancient cultivation in,' letter by C. Vita-Finzi, 475
Nene river, *see* East Anglia
Netherlands, "Historische geografie van Westelijk Zeeuws-Vlaanderen," by M. K. E. Gottschalk, note on, by J. L. M. Gulley, 463–5
Newell, D. J., and snow accumulation, Antarctic, 350
Newfoundland, Durham Univ. Explor. Soc. Expedn., 133

New Hebrides, *Espiritu Santo* (*Nouvelles Hébrides*): J. Guiart, 436–7
Newton, K., *Essex and the sea*, 420–2
NEW ZEALAND AFTER TWENTY YEARS: GEOGRAPHER'S VIEW: K. B. Cumberland, 38–47; Canterbury and west coast, bibliography of maps, 284–5; Dominion Settlement Population Assocn., 284; *Great days in New Zealand mountaineering:* J. Pascoe, 436
New Zealand Geogr. Soc., Second Triennial Conference, 282
New Zealand Journal of Geol. and Geophysics, articles on Antarctica, 284
Nigeria, Northern, *Adamawa past and present:* A. H. M. Kirk-Greene, 108; *Katsina province, Land and population in:* A. T. Grove, 108–9
NIGERIA, SOUTHERN, INFLUENCE OF EUROPEAN CONTACTS ON LANDSCAPE OF: W. B. Morgan, 48–64
Nile, *Four thousand miles of adventure:* A. Davy, 450; *Tears of Isis:* R. Carrington, 450; WATER HYACINTH: NEW PROBLEM ON THE NILE: P. A. Gay and L. Berry, 89–91
Norfolk we live in, The: P. W. Blake and others, 449
Norris, H. T., IBN BAṬṬŪṬAH'S ANDALUSIAN JOURNEY, 185–96
Norsel, and *Thala Dan*, 331
Norsk Polarinstitutt, and mapping of Spitsbergen, 80–1
North, F. J., *Sunken cities*, 102–3
Norway, Durham Univ. Explor. Soc. expedns. to Lyngen peninsula, 1956, and Mauranger, 1958, 456
Norwegian-British-Swedish Antarctic expedn., *see* Antarctic
Nottingham Univ., and survey of Veitestrondvatn, Norway, 359, 368
Nottingham Univ., Dept of Geogr., issues "Bulletin of material on geogr. of U.S.S.R.," 285
Noyce, W., *Climbing the Fish's Tail*, 449
Nye, J. F., on glacier flow, 360, 369

Océans, Les, L. Rouch, 442
Onelli, lake and glacier, Patagonia, 315 *et seq.*
Ordnance Survey annual report, 131
Ore, river, Movement of shingle at mouth of, 380 *et seq.*
Orfordness, Suffolk, and movement of shingle, 380 *et seq.*
Outhwaite, L., *Atlantic*, 116
Overbeck, H., *see* Fels, E.
Oxford Expedns., *see* Chitral; Tanganyika

Pacific, *Among savages of South Seas:* A. Tetens, 117–18
Pakenham, T., *Mountains of Rasselas*, 450
Pakistan, Basic data of economy of: W. N. Peach, M. Uzair and C. W. Rucker, 256–258
Pakistan, East, Economic geogr. of: N. Ahmad, 256–8
PALLISER, CAPTAIN JOHN, AND EXPLORATION OF WESTERN CANADA: I. M. Spry, 149–84
Palmier, L. H., article "Constitution and geogr. in Indonesia," 138
Parker, W. H., obit. of H. R. Thompson, 473–4
Parry, M., *see* Miller, A. A., and M. Parry
Parsons, E. J. S., and Sir F. Stenton, *Map of Great Britain, circa A.D.* 1360, *known as Gough Map*, 237–9
Pascoe, J., *Great days in New Zealand mountaineering*, 436
PATAGONIA, EXPLORATION IN: E. Shipton, 312–25
Paterson, S., surveyor with Survey of South Georgia, 25 *et seq.*
Pathans: Sir O. Caroe, *rev. art.* by Lord Birdwood, 414–16
Paysages agraires: A. Meynier, 425
Peach, W. N., M. Uzair and C. W. Rucker, *Basic data of economy of Pakistan*, 256–8
PEAT, COMMERCIAL USE OF, IN NORTHERN IRELAND: J. H. Johnson, 398–400
Percy Sladen Trust, aid to Shipton expedn. to Patagonia, 312
Perse School, Cambridge, and Austerdalsbre, Norway, 357
Peru, *Quest for Paititi:* J. Tennant, 124; SOME ASPECTS OF AGRICULTURE AND SETTLEMENT IN: C. T. Smith (*title only*), 292; *Peruvian adventure:* W. Brown, 264
Philby, H. St.J. B., EASTERN MARSHES OF MESOPOTAMIA, 65–9; letter on 'Marshes of southern Iraq,' 143–4
Philipps, J. E. T., obit. by E. Hindle, 473
Photogrammetry, Outline of: K. Schwidefsky, 445
Plant life, and climatic changes, 4–5
Poland, maps from, 131–2
Polar atmosphere symposium: Pt. I, *Met. Section:* ed. R. C. Sutcliffe, 264–6
Polar Maid, and Survey of South Georgia, 23
Population, Géographie de la, Tome 2: J. Beaujeu-Garnier, 271
Portugal, *Hills of Alentejo:* H. V. Beamish, 103–4; *Masznahmen zur Förderung der privaten Kapitalbildung im portugiesischen Reich:* R. von Gersdorff, 252; *Selective traveller in:* A. Bridge and S. Lowndes, 276
Pratt, J. G. D., and H. Lister, GLACIOLOGICAL RESEARCH ON TRANS-ANTARCTIC EXPEDN. (*title only*), 292; *see also* Lister, H., and J. G. D. Pratt
Price, T., mountaineer, Survey of South Georgia, 25 *et seq.*
Priestley, Sir R., Founder's Medal to, 278, 478; remarks at A.G.M., 478–9
Pudsey-Dawson, P. A., *see* Grover, J. C.
PUNA DE ATACAMA, PLUVIAL AGE IN: C. Vita-Finzi, 401–3

Querini Stampalia, Venice, and catalogue of historic maps, 470

RAKAPOSHI, ASCENT OF: M. E. B. Banks and J. Mills (*title only*), 477
Rassam, H., and Assyrian excavations, 197
Rau, S. R., *View to the south-east*, 106–7

Rawlinson, Lord and Lady, and Assyrian sculptures, 197–8
Rawlinson, Sir H. C., and Assyrian excavations, 197
Reddaway, A. F. J., made C.M.G., 125
Rees, W., *Historical atlas of Wales from early to modern times*, 248
Reichert, expedn. to Patagonia, 320
Renault, G., *Caravels of Christ*, 447
Rennell, Lord, *Valley on the March*, 246–7; letter on 'Valley on the March,' 476
Resolution, and South Georgia, 20
Rheinland-Pfalz in seiner Gliederung nach zentralörtlichen Bereichen: R. Klöpper and J. Körber, 250–1
Rhodesia, *Birth of a dilemma:* P. Mason, 433–434
Rhodesia, Northern, *The long grass:* T. W. Lawman, 111–12
Rhondda valleys: E. D. Lewis, 419–20
Riches, Maj.-Gen. I. H., made C.B., 125
Richter, C. F., *Elementary seismology*, 267–8
Riebeeck, Jan van, *see* Van Riebeeck, Jan
Riley, Q., obit. of A. Courtauld, 287
Rittlinger, H., *Ethiopian adventure*, 450
Roberts, C. F., *see* Ginsburg, N., and C. F. Roberts
Roberts, D. F., remarks on "Study of geogr. of disease," 215–16
Robin, G. de Q., *see* Swithinbank, C.
Roots, W., mountaineer with Survey of South Georgia, 21 *et seq.*
Rouch, L., *Les Océans*, 442
Rouillon, G., leader French expedn., Terre Adélie, and *Thala Dan*, 331
Rowley, D. M. R., *see* Bostock, H. S., and D. M. R. Rowley
R.A.A.F., medical team in Borneo, 302
Royal Geogr. Soc., and J. Palliser, 151 *et seq.*; Annual Dinner, 481–90; Annual General Meeting, 477–81; applications for grants 1960, 279, 453; ASSYRIAN SCULPTURES IN COLLECTION OF: R. D. Barnett, 197–8; conferences held at Society's house, 125; contributions to *Journal*, 128, 280, 454; exchange of telegrams with H.M. The Queen at A.G.M., 481–2; Fellows' subscriptions under covenant, 453–4; G.C.E. geogr. prizes, 453; geogr. essay prize, 1959, and conditions for, 1960, 452; Grants to expedns., 1959, 278; instruments lent to Shipton expedn. to Patagonia, 313; *Journal* a hundred years ago, 92, 236, 404; Library, Soviet geogr. serials in, 136–137; Medals and awards, 278, 478–81; meetings: Session 1958–9, 146–8; new members of Council, 452; PRESIDENTIAL ADDRESS, 1959: Lord Nathan, 293–8; special meetings and films 1958, 125–6; UNESCO exhibition "Earth as planet," 126–7
Royal Scottish Geogr. Soc., annual meeting Nov. 1958, 130–1
Rubin, M., U.S. Observer at Mirny, Antarctica, 333
Russians in Arctic: T. E. Armstrong, 253–4
RUWENZORI, GLACIERS OF MOUNT BAKER,: J. B. Whittow, 370–9; Makerere College Reconnaissance, 133, 370 *et seq.*
Ryan, I., *Black man's palaver*, 111
Sahara, *Studien zum vor- und frühgeschichtlichen Landschaftswandel der Sahara:* K. W. Butzer, 109–10; SAHARAN SURVEY, A. R. Akester (*title only*), 147
St. Lawrence, Bourdon plans for first French settlements on, 435
St. Lawrence Seaway and power project, note on, 458
Sarawak, *Longhouse and jungle:* G. Arnold, 426–7
Sarawak Government, and air strips, 301
Saville, J., *Rural depopulation in England and Wales*, 1851–1951, 418–19
SAXTON, CHRISTOPHER, TWO NEWLY DISCOVERED MANUSCRIPT MAPS BY: G. R. Batho, 70–4
Schubert, H. R., *British iron and steel industry*, 100
Schultze, J. H., *Alexander von Humboldt*, 405–6, *see also* Fels, E.
Schwidefsky, K., *Outline of photogrammetry*, 445
Schytt, V., *see* Swithinbank, C.
Scottish Field Studies Assocn., programme for 1959, 138
Seal, J., Sarawak civil aviation officer, 302
Seckford, T., and C. Saxton, 70–1
Sedov, Russian ice-breaker, and ice thickness in Arctic, 2
Seismology, Elementary: C. F. Richter, 267–8
Seligman, G., Victoria Medal to, 278, 479; remarks at A.G.M., 479
Serjeant, R. B., and map of Southern Arabia, 294
Seychelles, *Beyond the reefs:* W. Travis, 277
Shaw, N., Secretary R.G.S., and J. Palliser, 152
Shaw, V., *see* Eversley, D. E. C.
Sheffield, Univ. of, news notes by A. Garnett, 128–30
Sherborne Expedn., *see* Himalaya
SHINGLE, MOVEMENT OF, OVER SEA BED CLOSE INSHORE: C. Kidson and A. P. Carr, 380–9
Shipton, E., EXPLORATION IN PATAGONIA, 312–25
Sievewright, D. J., and T. Lloyd, *Canada and her neighbours*, 112–13
Simpson, Sir G., and J. Palliser, 153 *et seq.*
Singapore land use map 1:6336, *Sheet* 5/49: Singapore Improvement Trust, 274–5
Siple, P. A., SOUTH POLE STATION (*title only*), 147
Skelton, R. A., 'Medieval map of Britain,' *rev. art.*, 237–9
Sledging ration, Survey of South Georgia, 35–6
Slimming, J., *Temiar jungle*, 107
Smillie, G., surveyor, Survey of South Georgia, 21 *et seq.*
Smith, A. G., leads students across Usun Apau, 309
Smith, D. T., and Austerdalsbre, Norway, 359
Smith, C. T., SOME ASPECTS OF AGRICULTURE AND SETTLEMENT IN PERU (*title only*), 292
Smith, G.-H., *Conservation of natural resources*, 442
Smythies, B. E., and Kinabalu fauna, 309

Soc. Industrielle Télécommande/Télémécanique, and equipment for *Thala Dan*, 326
'Soil science,' letter by A. Young, 475–6
Solomon Islands: J. C. Grover, P. A. Pudsey-Dawson and R. B. M. Thompson, 266
South Georgia, British expedn., 1954–5, 25; "South Georgia Survey," letter on, 291; Survey of, contributions to and costs, 36–7
SOUTH POLE STATION: P. A. Siple (*title only*), 147
Southern Opal, and Survey of South Georgia, 21
Soviet Central Asia and Kazakhstan, Map of, by Central Asian Research Centre, note on, 462–3
Soviet geogr., Developments in, note on, 469–70
Soviet geogr. serials in Society's library, 136–137
Spain: W. B. Fisher and H. Bowen-Jones, 252–3
Spenceley, G., photographer with Survey of South Georgia, 25 *et seq.*
Spofforth, Yorkshire, Saxton's plans of, 70 *et seq.*
Spitsbergen, Birmingham and Exeter Univs. joint Expedn., 132; Cambridge Expedn., 132; MAPPING IN JAMES I LAND, VEST-SPITSBERGEN: F. B. Kennedy, 80–3; Queen's Univ. of Belfast expedn., 1957, 80 *et seq.*
Spry, I. M., CAPTAIN JOHN PALLISER AND EXPLORATION OF WESTERN CANADA, 149–84
Stamp, L. D., 'Outstanding national atlas,' *rev. art.*, 96–7; receives Honorary Doctorate of Stockholm School of Economics, 452; remarks on "Study of geogr. of disease," 214–15
Stanley, D. M., obit., 473
Stanley, L. T., *Journey through Cornwall*, 277
Stark, F., *Alexander's path*, 104
Stearn, W. T., *Botanical exploration to the time of Linnaeus*, 447
Steinhauser, F., and others, eds., *Klimatographie von Österreich*, 424–5
Stenning, E. H., *Portrait of Isle of Man*, 248
Stenton, Sir F., *see* Parsons, E. J. S., and Sir F. Stenton
Stephens, R. W., *Population pressures in Africa south of Sahara*, 433
Stobart, T., autobiogr., *Adventurer's eye*, 122–3
Stratton, D., Back Grant to, 278, 480; remarks at A.G.M., 480
Stuart, John McDouall: M. S. Webster, 435–436
Sudan, Egypt in: R. Hill, 429–30; *Facts about Sudanese:* K. J. Krolki, 430; Population of: maps, 132
Sullivan, J. W., secretary and astronomer with Palliser expedn., 156 *et seq.*
Sutcliffe, R. C., ed., *Polar atmosphere symposium: Pt.* I, *Met. Section*, 264–6
Sutton, G., and British South Georgia Expedn., 1954–5, 25
Sweeting, M. M., letter on "Karstlands of Jamaica," 289–91
Swithinbank, C., remarks on "Geophysical investigations of Commonwealth Trans-Antarctic Expedn.," 354
Swithinbank, C., V. Schytt and G. de Q. Robin, *Norwegian-British-Swedish Antarctic expedn., scientific results. Glaciology*, 239–43
Switzerland, Durham Univ. Explor. Soc. expedn., 1956, 456

Tagliacarne, G., *Lo studio delle aree di mercato in Italia*, 422–3
Tanganyika, Oxford Univ. Expedn., 132
Taylor, E. G. R., Lecture, 279
Taylor, G., autobiogr., *Journeyman Taylor*, 121–2
Taylor, J. A., and R. A. Yates, *British weather in maps*, 102
Tempany, Sir H., and D. H. Grist, *Introduction to tropical agriculture*, 270–1
Tennant, J., *Quest for Paititi*, 124
Terray, L., and French expedn. to Mt. Fitzroy, Patagonia, 312
Tetens, A., *Among savages of South Seas*, 117–18
Thala Dan, M.V., *see* Antarctic
Thom, H. B., ed., *Journal of Jan van Riebeeck*, 434
Thompson, D., geographer, western Canada, 153 *et seq.*
Thompson, H. R., obit. by W. H. Parker, 473–4
Thompson, R. B. M., *see* Grover, J. C.
Thomson, W. P. G., obit. by L. P. Kirwan, 474
Thorpe, H., *see* Harvey, P. D. A., and H. Thorpe
TIBESTI REGION, GEOMORPHOLOGY OF: A. T. Grove (*title only*), 146
Tilman, H. W., expedn. to Patagonia, 312
Times atlas, see Atlas, Times
Tolstikov, Y. I., at Mirny, Antarctica, 333
Tomlinson, R. F., and survey of Veitestrondvatn, Norway, 359, 361, 368
Transactions Inst. British Geographers. Publ No. 25, 447–8
TRANS-ANTARCTIC EXPEDN., GLACIOLOGICAL RESEARCH ON: J. G. D. Pratt and H. Lister (*title only*), 292
Travis, W., *Beyond the reefs*, 277
Tregear, T. R., *Hong Kong gazetteer*, 428; *Land use in Hong Kong and the New Territories*, 106
Trendall, A., geologist with Survey of South Georgia, 21 *et seq.*
Tresco Valhalla, Scilly Isles, 467
Treshnikov, A. F., at Mirny, Antarctica, 333
t'Serstevens, A., *Mexico, three-storeyed land*, 435
Turco-Egyptian frontier, historical note by Gen. Sir J. Marshall-Cornwall, 459–62
Turkey, *Alexander's path:* F. Stark, 104
Turnor, R., geographer, western Canada, 153–4

U.S.S.R., Geographical sciences in, 133–6; *Guest of the Soviets*, 451; *see also* Caucasus; Soviet Central Asia

Ulster Year Book, 1957–9, note on, 471
UNESCO, *Arid zone research*, Vols. IX, X and XI, 269–70
UNESCO exhibition "Earth as planet," 126–127
United States, *Industrial evolution of Columbus, Ohio:* H. L. Hunker, 113; *Travels of William Bartram:* F. Harper, 114
U.S. Scrub Typhus Research Unit, and Kinabalu fauna, 309
Upsala Glacier, Patagonia, 315–16, 318

'Valley on the March,' letter by Lord Rennell, 476
Van Paassen, C., *Classical tradition of geography*, 272–3
Van Riebeeck, Jan, Journal of: ed. H. B. Thom, 434
Vestspitsbergen, *see* Spitsbergen
Viedma, lake and glacier, Patagonia, 314 *et seq.*
Villiers, A., *Give me a ship to sail*, 277
Vita-Finzi, C., letter on 'Ancient cultivation in Negev,' 475; PLUVIAL AGE IN PUNA DE ATACAMA, 401–3

Wales, Historical atlas of, from early to modern times: W. Rees, 248; *Sunken cities:* Wales, F. J. North, 102–3; *see also* British Isles, Celtic lands; England and Wales; *Midlands, West*
Walker, P. J., and Austerdalsbre moraines, 357, 362–3, 368
Wallace, A. R., and Sarawak, 299
'Wallin, G. A., and Royal. Geogr. Soc.,' article by W. R. Mead, 458
Walton, K., deputy leader, Survey of South Georgia, 21–2
Warburton, K., doctor with Survey of South Georgia, 23 *et seq.*
Warr, T., death of, 133; *see also* Karakoram
Warwickshire, Printed maps of: P. D. A. Harvey and H. Thorpe, 417
'Water use survey,' letter on, 145–6
Waters, D. W., *Art of navigation in England in Elizabethan and early Stuart times*, 418
Webster, M. S., *John McDouall Stuart*, 435–436
Wechsberg, J., *Avalanche*, 268–9
Weidner, E., and Assyrian sculptures, 197
Westminster Hospital Expedn., *see* Congo, Belgian
Wheatley, P., 'Leaf of the wild plum when autumn has come,' *rev. art.*, 407–11
Whitney, Hon. J. H., speech at Annual Dinner, 482–3
Whittow, J. B., GLACIERS OF MOUNT BAKER, RUWENZORI, 370–9
Wiggins, W. D. C., letters on 'Training of cartographers,' 140–2
Wilhelm, F., *Die Neuauslotung des Chiemseebeckens*, 423–4
Wilhelmy, H., *Klimamorphologie der Massengesteine*, 438–9
Wilkins, Sir H., obit. by J. Grierson, 139–40
Williams, H., *Landscape of Alaska*, 112
Williams, P. J., letter on Arctic "vegetation arcs," 144–5
Williams, W. M., *Country craftsman*, 418–19
Wise, M. J., note on British Assocn. Meeting, 1959, 456–8; *Pictorial survey of England and Wales: Section* VI. *West Midlands*, 247
Witthauer, K., *Die Bevölkerung der Erde*, 120–1
Woldstedt, P., *Das Eiszeitalter*, 266–7
Wooldridge, S. W., elected F.R.S., 452
Wordie, Sir J., remarks on "Geophysical investigations of Commonwealth Trans-Antarctic Expedn.," 354
'World population pressures,' by H. L. Geisert, note on, 471
Worthington, E. B., *Science in development of Africa*, 98–9
Wye College Expedn., *see* Iceland
Wynne-Edwards, C. J., HYDROGRAPHIC SURVEY IN FALKLAND IDS. ANTARCTIC DEPENDENCIES (*title only*), 147

Yates, E. M., HISTORY IN A MAP (*title only*), 477
Yates, R. A., *see* Taylor, J. A., and R. A. Yates
Yemen: H. Helfritz, 255
Young, A., and moraine survey Austerdalsbre, Norway, 357, 362, 368; letter on 'Soil science,' 475–6

Zeeuws-Vlaanderen, *see* Netherlands
Zoogeography: P. J. Darlington, *rev. art.* by E. Hindle, 243–5

INDEX TO MAPS AND PLANS

BRITISH ISLES

Northern Ireland, peat bogs, 399
Suffolk, Ore mouth, plans of shingle tracing operations, 384, 386–8; river Ore, 383
Yorkshire, Saxton's map of Spofforth, 70

EUROPE

Europe, bird distribution, 3, 7, 8
Gibraltar, in Middle Ages, 186
Iceland, Hagavatn, 85
Norway, Austerdalen, 358; Austerdalsbre glacier, 368
Spitsbergen, marine species distribution, 13; Vestspitsbergen, 81; James I Land, 82

ASIA

Borneo, 1947, 300; Brunei/Sarawak/Kalimantan, 302
Iraq, Eastern marshes, 66; Lower Diyāla area, 391, 392
Sinai/Negev, 460

AFRICA

Chad, 466

Nigeria, Southern, 50, 55; Iwo, land use, 57; Ondo, Idanre villages, 60
Ruwenzori, glaciers of Mount Baker, 371; Moore glacier, 1958, 377
Sudan, upper White Nile valley, 90

EUROPE AND AFRICA

Spain/Morocco, 188

NORTH AMERICA

Black's atlas, part of, 164
Canada, British Columbia, 161, 220; J. Palliser's expedn., 176; Ontario, 159

SOUTH AMERICA

Patagonia, 313; lakes Viedma and Argentino and environs, 315
Puna de Atacama, 402

AUSTRALASIA

New Zealand, 40

POLAR REGIONS

Antarctic, Amundsen Bay and environs, 340; South Georgia, 24, 28–9; track of *Thala Dan*, 327

INDEX TO ILLUSTRATIONS AND DIAGRAMS

BRITISH ISLES

British Isles, sea temperatures, 10
England, monthly mean temperatures, 17
Nene and Great Ouse, flood frequency diagrs., 224–8
Suffolk coast, tracing movements of shingle, 388–9

EUROPE

Iceland, dirt cone, 85; glacier surfaces, 86; Hagavatn, 84, 85; Mosaskard, 85
Norway, Austerdalen and Langedalen from Vårstölen, 361; Austerdalsbre variations, 364; Austerdalsbre, glacier snout 1937 and 1957, 360; profile of Austerdalsbre glacier, 367; Veitestrondvatn soundings, 359
Spain, Algeciras, Castellar, 192; Alhambra, Gate of Justice, 193; Ronda, Moorish tower, 193; Tarifa, "fire-tower," 192

ASIA

Borneo, Mount Kinabalu; waterfall on Usun Apau; menhirs in jungle on Kelabit uplands; dolmen on Kelabit uplands, 304–305
Iraq, Diyāla weir, 394; Ba'qūba, Diyāla and ancient Nahrwān Canal, 395

AFRICA

Egypt, dune profile, 76
Sudan, water hyacinth, 92
Ruwenzori section of Upper Mobuku Valley, 375; southern glaciers of Mount Baker; roche moutonnée, Mount Baker, 372; Moore glacier, 373

NORTH AMERICA

Canada, Schefferville–Seven Ids. iron ore railway routed round string bogs, 127
British Columbia, camp on mountain pass; Douglas Channel; Kemano, 220–1
St. Lawrence Seaway, 293

AUSTRALASIA

New Zealand, Auckland, 43; Kawerau, 43; Otago, Roxburgh hydro-electric station, 42; Waioru, aerial top dressing, 42

POLAR REGIONS

Antarctic, Davis Station, A.N.A.R.E., and Larsemann Hills, 336–7; Fold Id., 233; Gentoo penguins, 24; ice crystal, 355; meteorological diagrs., 346; natural arch, Mt. Sabatier, 25; Neumayer glacier, 24; Radok and Beaver lakes, 232; scientific work on Trans-Antarctic Expedn. 344–5; seismic profile, 352; snow accumulation at "Southice," 344; Spenceley glacier, 25; surface morphology, 347; view from Mt. Patterson, 25

GENERAL

Assyrian sculptures, 196–7
Palliser, J., portrait, 149, 165
Royal Geogr. Soc., Lord Nathan, Lady Mawson and Sir E. Harrison, and portrait of Sir D. Mawson, 279; Lord Nathan presents Patron's Medal to Comdr. W. R. Anderson, 296; UNESCO I.G.Y. Exhibition, Earth satellites, 126; Gen. Laclavère, Lord and Lady Nathan, 126

END OF VOL. CXXV

MADE AND PRINTED FOR THE ROYAL GEOGRAPHICAL SOCIETY BY
WILLIAM CLOWES AND SONS, LIMITED, BECCLES, ENGLAND

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

FELLOWSHIP

The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £2 each; *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £3 each. Thereafter the Annual Subscription may continue to be paid in four quarterly instalments of £1 each or two half-yearly instalments of £2 each respectively. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order. Half-yearly instalments shall be due on the 1st January and the 1st July; quarterly instalments shall be due on the 1st January, 1st April, 1st July and 1st October.

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from £4 to £2. The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £1 10*s*. 0*d*. each *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £2 10*s*. 0*d*. each: thereafter payment may be by instalments as above. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order.

Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 less £2 for each Annual Subscription paid in excess of five with a minimum of £20 after 25 payments.

No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

ASSOCIATE MEMBERSHIP

The Bye-Laws covering the terms of Associate Membership provide that—

1. *A candidate must be not less than 17 and not more than 20 years of age. He (or she) must be recommended by a Fellow, University or School authority.*
2. *Subscription shall be £2 per annum without Entrance Fee.*
3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

PRIVILEGES OF FELLOWS AND ASSOCIATE MEMBERS

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library and Map-room. Each Fellow is also entitled to receive a copy of *The Geographical Journal*. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

Made and printed in Great Britain
for the Royal Geographical Society
by William Clowes & Sons, Ltd., Beccles
Entered as second class mail matter (5 *January* 1898) *in the*
New York Post Office, N.Y.